THE

JOURNAL OF GAS LIGHTING,

WATER SUPPLY, & SANITARY IMPROVEMENT.

[Registered as a Newspaper.]

Vol. XXIV. No. 607.] LONDON, DECEMBER 29, 1874. [26th Year.] Price 6d.

RAMSAY'S NEWCASTLE CANNEL

COAL. Analysis—10,000 cubic feet of gas per ton of coal; 26-candle gas; 13¼ cwt. coke per ton of coal.

The London Exhibition in 1851 was lighted with gas made from Ramsay's Cannel.

RAMSAY'S PATENT CONDENSED COKE.
DO. GARESFIELD COKE.

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GAS-RETORTS, introduced 1828. FIRE-BRICK WORKS, established 1804. FIRE-CLAY SANITARY PIPES, CHIMNEY-TOPS, and all Goods made of Fire-Clay. The Fire-Clay is worked from Blaydon Main Colliery, is of excellent quality, and no expense spared in perfecting every article. The FIRE-BRICKS (marked "RAMSAY") are to be seen in all parts of the world, and the Works are the most extensive in the Kingdom.

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These Paints are now used in 100 Country Gas-Works, and by all (but one) of the London Gas Companies, on Gasholders, Scrubbers, Purifiers, &c. They will cover tar effectually. Also used by the Admiralty, War Office, Railway Companies, Founders, &c.

They prevent and arrest rust, and protect iron from the action of water, sulphurous and gaseous exhalations.

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JOSEPH COWEN and CO.,
BLAYDON BURN, BLAYDON-ON-TYNE,

Were the only parties to whom a Prize Medal was awarded at the Great Exhibition of 1851, for "Gas-Retorts and other Objects in Fire-Clay," and they were also awarded at the International Exhibition of 1862, the Prize Medal for "Gas-Retorts, Fire-Bricks, &c., for Excellence of Quality."

J. C. and Co. have been for many years the most extensive Manufacturers of Fire-Clay Retorts and Fire-Bricks in the Kingdom. Orders for Fire-Clay Retorts of all shapes and dimensions, and to fit any shaped Mouthpiece, Fire-Bricks, and every other article in Fire-Clay, are promptly executed at their Works as above.

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Established at the commencement of Gas Lighting.
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J. R. and Co. make all kinds of Tubes and Fittings for Gas, Steam, and Water; Gun-Metal Cocks, Stocks, and Dies; Galvanised Tubes and High-Pressure Tubes, &c.

Lists may be obtained on application to
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And Gas Apparatus of every Description.
Marine, Tubular, Cornish, Plain, Furnace, Saddle, and Range Boilers.
Sugar, Saltpetre, and all kinds of Pans.
Roofs, Girders, and Bridges, and General Smith's Work.
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J. & W. ROMANS,
GAS ENGINEERS AND COAL FACTORS,
OF
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CONTRACT FOR SUPPLYING ANY QUANTITY OF
GAS, HOUSE, and STEAM COAL, and CANNEL;
Also for every sort of Gas Apparatus and Fire Goods.

Messrs. Romans, being lessees of several Gas-Works, have their Cannels tested in the ordinary working process, thus securing for their customers a guarantee beyond mere laboratory experiments.

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For the English Government, and for the Government of the Netherlands;
MAKERS OF THE DUPLICATE COPY
Presented by Her Majesty's Government to the French Government;
AND MANUFACTURERS OF
IMPROVED
DRY GAS-METERS,
Warranted to Measure correctly, and not to vary.

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236, GEORGE STREET, GLASGOW; and 15, MARKET STREET, MANCHESTER.

G. G. and Co. have just received the only Medal awarded for Gas-Meters at the Vienna International Exhibition.

SILVER MEDAL, PARIS EXHIBITION, 1867.

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MANUFACTURERS OF

WROUGHT-IRON TUBES AND FITTINGS

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LAP-WELDED IRON AND HOMOGENEOUS METAL BOILER TUBES.

Boiler-Tube Ferrules, Gun-Metal Gland Cocks, Water-Gauges, Whistles, &c.; Stocks, Taps, and Dies for Screwing, and Gas-Fitters Tools.

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AND EVERY DESCRIPTION OF FIRE-CLAY GOODS.

N.B.—A Stock of 15 and 16 in. CIRCULAR RETORTS always on hand. Other kinds made to order on short Notice.

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PATENT IMPROVED SEAL

FOR

GAS HYDRAULIC MAINS.

SAVES COAL, RETORTS, FUEL, LABOUR, TIME, SPACE, AND CAPITAL.

PREVENTS STOPPAGE OF ASCENSION-PIPES, DEPOSITION OF CARBON IN RETORTS, THICKENING OF TAR IN HYDRAULIC MAIN.

GIVES MORE GAS PER TON OF COAL, WITH HIGHER ILLUMINATING POWER, SATISFACTION, AND PROFIT TO SHAREHOLDERS AND MANAGERS.

IS STRONG, SIMPLE, EASILY FIXED AND WORKED, AND THOROUGHLY EFFICIENT AT ALL TIMES.

TESTIMONIAL.

Gas-Works, Guildford, Sept. 15, 1874.

GENTLEMEN,—The five retorts fitted with your Patent Moveable Seal for Dip-Pipes, on June 30, have been in constant use since that date, and have worked in a most satisfactory manner.

These Retorts are still quite clean and free from carbon, whilst others not so fitted, after being at work eight weeks, required scurfing, having a deposit of carbon 2 inches in thickness on the inside.

I also find a slight increase in the yield of gas per ton of coal carbonized, although your Patent Seals are fitted to but one-fifth of the Retorts now at work.

As your statements respecting your apparatus are fully confirmed by the results obtained in practical working, I should wish you at once to fix one to each of the ovens at these works, that I may obtain all possible advantage during the coming winter.

Yours truly,

Messrs. Caffall, Thomas, and Co., Limited, 28, Gracechurch Street, E.C. JOS. SHAW, Manager.

MODELS MAY BE SEEN, AND INFORMATION OBTAINED, AT THE OFFICES, 28, GRACECHURCH STREET.

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THE MEDAL FOR 1862.

The only Prize Medal awarded for TUBES & FITTINGS.

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GAS-FITTERS TOOLS, VALVES, COCKS, &c.

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CAST & WROUGHT IRON TANKS FOR DITTO;

PURIFIERS, CONDENSERS, SCRUBBERS, RETORTS, VALVES;

IMPROVED WROUGHT-IRON RETORT-LIDS, CROSS-BARS, & SCREWS;

AND GAS APPARATUS OF EVERY DESCRIPTION.

SOLE MANUFACTURERS OF LIVESEY'S PATENT GASHOLDER MAN-LID,

By use of which Man-lid, inlet and outlet pipes can be examined and cleansed without loss of gas in crown of holder, or ingress of atmospheric air.

ROOFS, GIRDERS, BRIDGES, AND BOILERS OF ALL KINDS.

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OLD HILL, near DUDLEY,

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HOWARD'S PATENT IMPROVED WROUGHT-IRON TUBES,

FOR GAS, STEAM, AND WATER;

Also ORDINARY WELDED WROUGHT-IRON TUBES and FITTINGS,

FOR GAS, STEAM, & WATER, EITHER BLACK, GALVANIZED, OR ENAMELLED.

CORE BARS FOR IRONFOUNDERS, STOCKS, TAPS, AND DIES, IRON COCKS, &c.

GAS PURIFICATION & CHEMICAL Co., LIMITED,

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Offices—PALMERSTON BUILDINGS, OLD BROAD STREET, LONDON, E.C.,

CONTRACTORS FOR GAS PURIFICATION BY OXIDE OF IRON.

The superiority of the material supplied by this Company is generally recognized, and it is now in use in nearly all the London and most of the large Provincial Gas-Works.

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WITH TALC REFLECTORS AND SELF-ACTING VALVES TO PREVENT DOWN-DRAUGHT;

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J. & H. ROBUS,

(Late of the Crystal Palace District Gas-Works, Sydenham, and the New City Gas-Works, Montreal, Canada,)

GENERAL CONTRACTORS & RETORT-SETTERS, FITTERS & MAIN-LAYERS.

RETORTS SET ON THE LATEST IMPROVED PLAN.

Retort-Setters sent to all parts of Europe and America.

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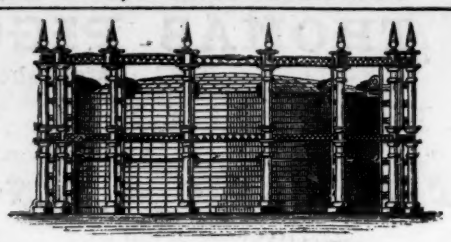

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GAS APPARATUS OF EVERY DESCRIPTION,

Including Improved

Retort-Lids, Boilers, Cast and Wrought Iron Tanks, Iron Roofing, Bridges, Girders,

And GENERAL IRONWORK.

N.B.—Estimates for all Gas Plant and Remodelling supplied on application.

THE

LANCASHIRE GAS-METER COMPANY,

LIMITED,

FALCON STREET, OLDHAM.

HENRY THOMAS, Managing Director.

JOHN WRIGHT AND CO., ESSEX WORKS, BIRMINGHAM,

Beg to call the attention of MANAGERS and DIRECTORS of GAS COMPANIES to the following letter which they have lately received.

COPY OF LETTER RECEIVED FROM MAGNUS OHREN, Esq.

To Messrs. John Wright and Co., Essex Works, Birmingham. *Crystal Palace District Gas Company, Lower Sydenham, S.E.*

Dear Sirs,—In reply to your inquiries, I am glad to state that the use of GAS COOKING AND HEATING STOVES has been a complete success here. We have several hundred in use in our districts. We also find it advantageous to let out Stoves at a small rental. We have now 275 Stoves at rent.

The Stoves you make I can with confidence recommend, having so many in use, and giving satisfaction. I need scarcely point out to you the advantage to Gas Companies to recommend the use of Gas Stoves to their Gas Consumers, even where they do not supply them on sale or rent, as the use of Gas Stoves brings day consumption, and thus the Company make a profit by day as well as by night.—I am, dear sirs, yours faithfully, MAGNUS OHREN.

Size, 25½ in. high; 14 in. wide; 12½ in. back to front.

Price 50s., complete with Pan and Gridiron.

GAS HEATING STOVES

(TERRA COTTA AND IRON).

THE CHEERFUL STOVE.

COOKING STOVES.

BREAKFAST COOKERS.

BATHS HEATED by GAS

GAS STOVES

For Boiling, Broiling, Preserving, Heating Flat Irons, and for all other Domestic Purposes.

Gas Companies and the Trade who have not our Illustrated Catalogue are respectfully requested to apply for same.

A LIBERAL DISCOUNT to the TRADE.

No. 4003.

THE CHEERFUL GAS STOVE, with Copper Reflector,

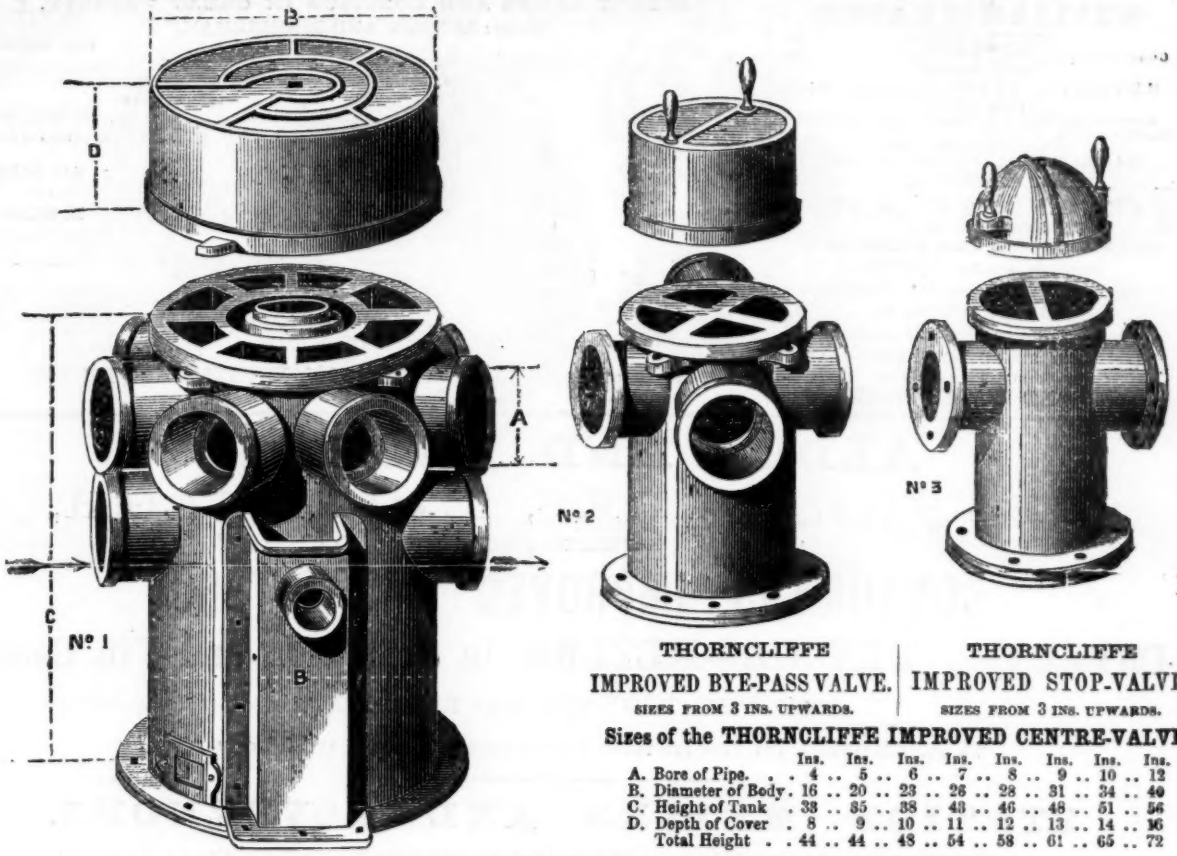
Has all the appearance of a Bright Fire.

PRICE from 32s

MESSRS. NEWTON, CHAMBERS, & CO.,

THORNCLIFFE IRON-WORKS, NEAR SHEFFIELD.

IMPROVED CENTRE-VALVES.



THORNCLIFFE
IMPROVED BYE-PASS VALVE.
SIZES FROM 3 INS. UPWARDS.

THORNCLIFFE
IMPROVED STOP-VALVE
SIZES FROM 3 INS. UPWARDS.

Sizes of the THORNCLIFFE IMPROVED CENTRE-VALVE.

	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.
A. Bore of Pipe. . .	4 ..	5 ..	6 ..	7 ..	8 ..	9 ..	10 ..	12
B. Diameter of Body .	16 ..	20 ..	23 ..	26 ..	28 ..	31 ..	34 ..	40
C. Height of Tank .	33 ..	35 ..	38 ..	43 ..	46 ..	48 ..	51 ..	56
D. Depth of Cover .	8 ..	9 ..	10 ..	11 ..	12 ..	13 ..	14 ..	16
Total Height . .	44 ..	44 ..	48 ..	54 ..	58 ..	61 ..	65 ..	72

In all cases the Covers are cast heavy enough to resist any required pressure.

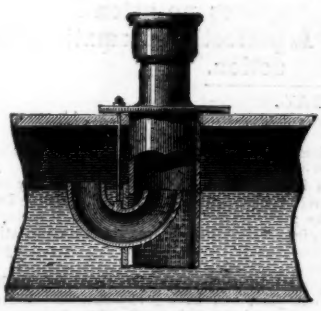
The advantages derived from the adoption of these Valves are so manifest and cardinal that in the immediate character of the change—the simplicity of the machine—the facility affording for cleaning out connexions between Valve and Purifier—the perfect collection and delivery by suitable overflow of the ammonia, at a greatly diminished depth from ground-line over the old form of Valve—the advantage of connecting on the same level, and at any angle, or opposite to each other, the inlet and outlet pipes without dip or rise—the clear acquisition of space in the purifying-house, by being able to place the boxes nearer together, the new Valve being entirely under the floor—and lastly, though of the greatest importance, the passage of crude and unpurified gas during the change is minimized to the merest fraction, thus preventing the fouling by impure gas the delicate machinery and easily affected exposed movements of the station-meter, thereby preventing the introduction of the enemy (unpurified gas) into the gasholder. Also a dead abutment is offered to all back pressure, imparting thereby to the gauges, governors, and hydraulic seals, a steadiness of action never realized with the once famous, but now fast becoming obsolete, Hydraulic Centre-Valve.

N., C., and Co. also Manufacture and Erect

PURIFIERS, CONDENSERS, SCRUBBERS, GASHOLDERS, ROOFS,

And every description of Gas Machinery.

TENDERS GIVEN FOR WORK FIXED COMPLETE IN ANY PART OF THE KINGDOM.



DIP-PIPE, No. 1.

Messrs. N., C., and Co. are also the Sole Agents for

HAWKINS' PATENT SELF-ACTING HYDRAULIC DIP-PIPES.

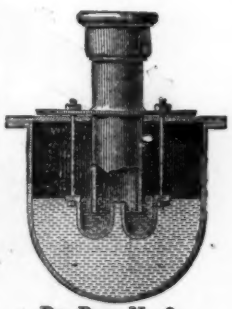
By their use the whole of the pressure caused by the Seal in the Hydraulic Main is entirely avoided, thus securing the many advantages long sought for.

Over 50 Gas Companies have already been supplied with them, many of which have been using them throughout their entire works continuously for over two years.

They can be applied to existing Hydraulic Dips, and at a very small cost.

They seal themselves in the same manner as the ordinary dip-pipes, therefore they are not likely to get out of repair.

By the aid of the adjusting screws they can be made to work on the old principle at pleasure.



DIP-PIPE, No. 2.

FOR PRICES, TESTIMONIALS, &c., APPLY TO

Messrs. NEWTON, CHAMBERS, & CO., Thorncliffe Iron-Works, near Sheffield, Sole Agents;

OR TO THE PATENTEE,

J. G. HAWKINS, NEEPSEND GAS-WORKS, SHEFFIELD.

BELGIAN CLAY RETORTS.

J. SUGG and CO., late ALBERT KELLER, GHENT.—The removal of the import duties on Earthenware permitting the entry of Clay Retorts into England, Messrs. Sugg, of Ghent, beg to draw the attention of the Gas Companies of London, and other Cities, to the very superior quality of the RETORTS manufactured by them. They can be made of any size, in one piece, and of any form. The price will be in proportion to the weight, and very moderate in comparison to their value.

Communications addressed to J. SUGG & CO., GHENT, will receive immediate attention.

FIRE-CLAY RETORTS.

WILLIAM FRASER,

INVERKEITHING,

Owner of the Works at which Fire-Clay Retorts were first made), can supply

RETORTS, FIRE-BRICKS, &c.,

to any extent.

References can be given to managers of above a hundred Gas-Works whom he supplies.

He ships at Charlestown his CELEBRATED HALBEATH STEAM COALS, on Navy List.

JAMES NEWTON & SONS,

(Established 1820,)

FIRE-BRICK AND TILE MERCHANTS,

Wholesale and for Exportation,

FALCON DOCK, 78 AND 79, BANKSIDE,

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DEPÔT for STOURBRIDGE AND NEWCASTLE FIRE-BRICKS, LUMPS, TILES, and FIRE-CLAY, and every Article suitable for

GAS AND WATER WORKS.

TO GAS COMPANIES AND THE TRADE.

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MANUFACTURERS OF

CRYSTAL, BRONZED, & ORMOLU CHANDELIERS, IMPROVED CRYSTAL STAR & SUN LIGHTS, VESTIBULE LAMPS, AND THE PATENT CRYSTAL ILLUMINATION.

A LARGE STOCK ALWAYS IN HAND OF

IRON, BRASS, COMPOSITE, AND LEAD TUBES, FOR GAS AND WATER,

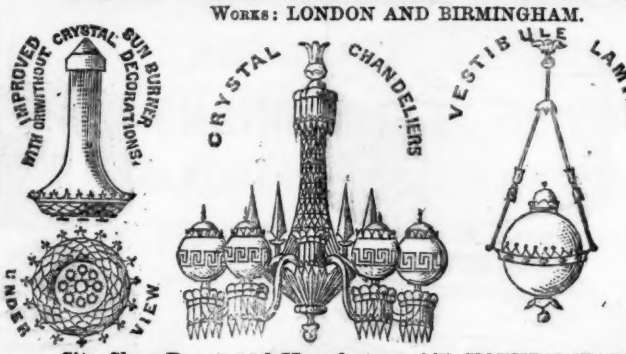
AND EVERY DESCRIPTION OF

GAS AND WATER FITTINGS.

THE PATENT DRY AND WET METER, WITH THE LATEST IMPROVEMENTS.

STREET LAMPS AND COLUMNS IN GREAT VARIETY.

WORKS: LONDON AND BIRMINGHAM.



GAS MOONS, Cut and Engraved, of the newest designs

GAS REFLECTORS In Silver and Glass

GAS NIBS AND BURNERS Of every description.

Pattern-Books of Gas-Fittings, Crystal and Ormolu Chandeliers for 1873, are now complete.

City Show-Rooms and Manufactory, 147, HOUNDSDITCH, LONDON.

ESTABLISHED 1830.

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GRANGE WORKS, EDINBURGH,

MANUFACTURERS OF

CONSUMERS IMPROVED GAS-METERS;

IMPROVED DRY GAS-METERS, in Cast Iron and Tin Cases,

OF THE HIGHEST EXCELLENCE,

Warranted to measure correctly, and not to vary.

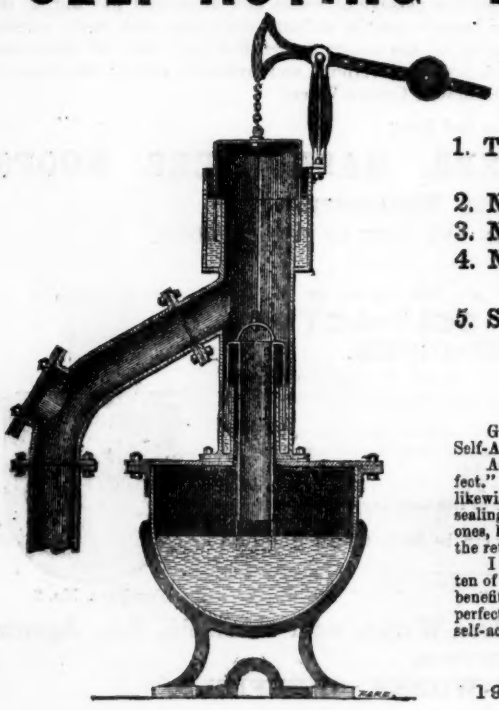
STATION METERS AND GOVERNORS,

EXPERIMENTAL METERS, PHOTOMETERS, GASHOLDERS, &c.

SELF-ACTING REMOVABLE DIP-PIPE,

PATENTED BY

CHANDLER & STEVENSON.



ADVANTAGES.

1. There is no pressure on the Retorts.
2. No deposit of Carbon.
3. No scurfing is required.
4. Never a choked Ascension-Pipe.
5. Saves Fuel and Wear and Tear.
6. Gets 10 per cent. more Gas out of the Coal, and a higher Illuminating Power.
7. Is never out of order.
8. Requires no attention.
9. Is perfectly automatic in its action.

TESTIMONIAL.

Metropolitan District Asylum, Caterham, Surrey, Dec. 14, 1874.

MESSRS. CHANDLER AND STEVENSON.

GENTLEMEN,—I have much pleasure in bearing testimony to the complete working of your "Patent Self-Acting Dip-Pipes," which have now been in constant operation over three months.

As regards the action of the apparatus, I can describe it no better than by calling it "simply perfect." Immediately the retort is charged and the lid secured, the small holder rises, which lifts the Dip; likewise the instant the gas is permitted to escape at the mouthpiece the holder falls, thus perfectly sealing the Dip. I am fully convinced of the superiority of these Self-Acting Dips over Non Self-Acting ones, having experienced the fact that stokers do occasionally neglect to unseal the Dip after charging the retort, thereby causing a waste or loss.

I feel that it is quite unnecessary for me to say more on the subject, excepting that, having had ten of Messrs. Chandler's Dip-Pipes in use more than one year, and having experienced the great benefits derived thereby, inasmuch as the yield of gas from the coal is greatly increased, and the retorts perfectly free from carbon and other advantages, and seeing that the same Dip has been made perfectly self-acting by the second patent, I feel convinced that this is the right thing.—Yours obediently,

W. CRICKMAY, Resident Engineer.

For terms of use and cost, apply to the Patentees,

19, GREAT GEORGE STREET, WESTMINSTER.

TANGYE BROTHERS AND HOLMAN,

LAURENCE POUNTNEY LANE, LONDON, E.C.,

SOLE MAKERS OF

MORTON'S PATENT SELF-SEALING RETORT-LIDS,

WITH

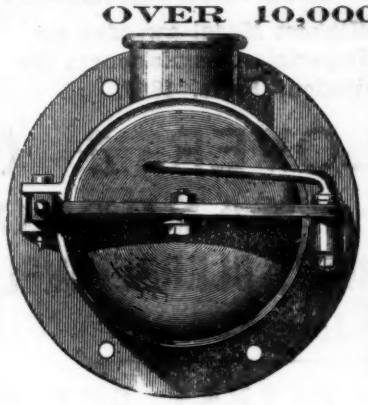
HOLMAN'S PATENT ECCENTRIC FASTENINGS & ANTI-FRICTION CATCHES.

OVER 10,000 IN USE.

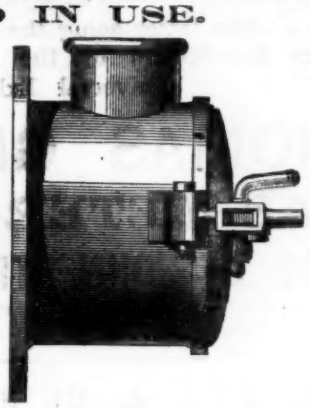
NO LUTING.

LIDS HINGED TO MOUTHPIECES; NO LIFTING ON OR OFF.

NO SCREWS FOR FASTENING.



FRONT VIEW.



SIDE VIEW.

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ECONOMICAL.

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EFFECTIVE.

NO DUPLICATE LIDS REQUIRED.

These Lids are proved by many eminent Gas Engineers to be the most efficient, saving much time, labour, and expense; are opened and closed as quickly and with as little trouble as an ordinary furnace door, and by their use the Retorts are soundly sealed during the whole period of carbonization.

These Lids are Adopted by the following (among many other) Gas Companies:—

The Gaslight Company, Beckton (where over 2000 are in use).	The West Ham Gas Company.	The Salford Corporation Gas-Works.	The Carmarthen Gas-Works.
„ Gaslight Company, Bow Common.	„ Imperial Gaslight Company.	„ Rochdale Corporation Gas-Works.	„ Merthyr Tydfil Gas-Works.
„ London Gaslight Company.	„ Gas-Works, Arsenal, Woolwich.	„ Liverpool United Gas-Works.	„ Ystrad Gas-Works.
„ Independent Gaslight Company.	„ Commercial Gas Company.	„ Birkenhead Gas-Works.	„ St. Alban's Gas-Works.
„ Phœnix Gaslight Company.	„ Alliance and Dublin Gas-Works.	„ Birmingham Gas-Works.	„ Over Darwen Gas-Works.
„ South Metropolitan Gaslight Co.	„ Edinburgh Gas-Works.	„ Nottingham Gas-Works.	„ Aylesbury Gas-Works.
	„ Manchester Corporatn. Gas-Works.	„ Newcastle-on-Tyne Gas-Works.	„ Cardiff Gas-Works.

The Morton's Lid is made circular in form, that being the most convenient and suitable shape. It can be used for Retorts of any section, by adapting the Mouthpiece casting from the D, oval, or other shape, at the back, to circular in front.

The following important Testimonial has been given:—

THE GASLIGHT AND COKE COMPANY

(*Commonly called the Chartered Gas Company*),

MESSRS. TANGYE BROTHERS AND HOLMAN. *Beckton, North Woolwich, July* 2, 1874.

Gentlemen,—In answer to your inquiry respecting the Self-Sealing Lids, I beg to say that they continue to work well, and I have every reason to be satisfied with them.

I should be very sorry to return to the old system of Luting, and our stokers here freely acknowledge the benefit to them of the new system.

I am, yours truly,

(Signed) G. C. TREWBY.

P.S.—We shall have very shortly about 3000 of your Lids in use.

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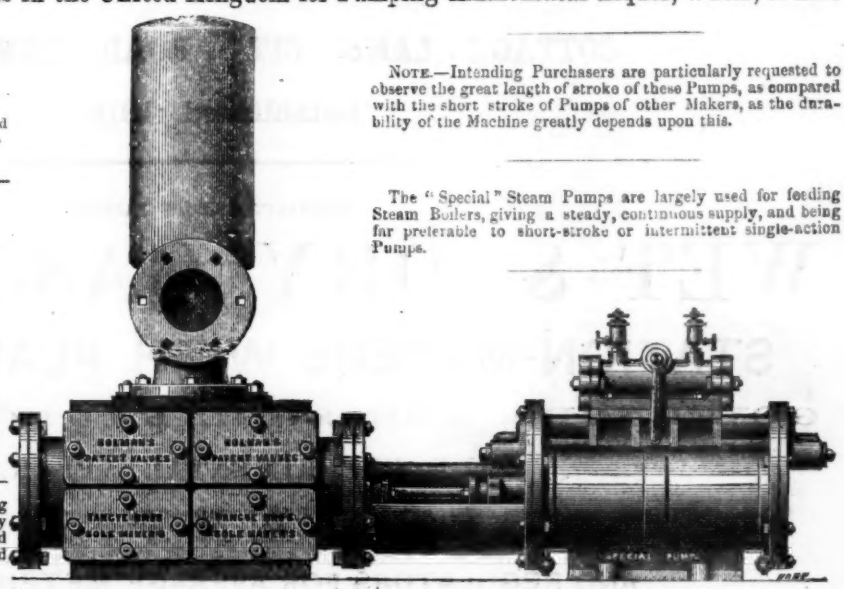
The following are a few of the leading Sizes:—

Diameter of Steam Cylinder.	Diameter of Water Cylinder.	Length of Stroke.	Gallons of Water per Hour, Approximate.	Reduced Prices.
3	1½	9	550	£16
4*	2	9	970	18
3	3	9	2,200	18
4*	3	12	2,200	20
6*	3	12	2,200	25
4	4	12	3,900	25
6*	4	12	3,900	30
6	5	12	6,100	35
7*	5	12	6,100	40
6	6	12	8,800	40
8*	6	12	8,800	50
7	7	12	11,900	50
10*	7	12	11,900	65
8	8	18	15,660	65
10	8	18	15,660	75
10	10	24	24,400	100

* These sizes being usually selected for pumping Tar and Liquor, are always in stock, or nearly ready, fitted with all pump details in iron, and extra length distance piece between steam and pump cylinder at a small extra cost.



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The "Special" Steam Pumps are largely used for feeding Steam Boilers, giving a steady, continuous supply, and being far preferable to short-stroke or intermittent single-action Pumps.

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London 1851. New York, 1853. Paris, 1855. London, 1862.

Dublin, 1865. Paris, 1867.

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THOMAS GLOVER & CO.,

DRY GAS-METER MANUFACTURERS,

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(SUCCESSORS TO SAMUEL CROSLEY,)

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STATION-METERS WITH PLANED JOINTS,

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METERS FOR MEASURING WATER.

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Vol. XXIV. (second half of 1874) will shortly be ready, bound in cloth, gilt letters, price 18s.

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THE JOURNAL OF GAS LIGHTING,
WATER SUPPLY, & SANITARY IMPROVEMENT.

TUESDAY, DECEMBER 29, 1874.

Circular to Gas Companies.

WHEN, last week, we wrote of the apathy of the London public with respect to the gas question, we had in our minds the imminence of St. Thomas's Day, and were quite prepared for some tall talk at the City Wardmotes. Knowing well, however, what ward meetings are, we should not have attached the smallest importance to language used at them, as representing public opinion, even in the City. As usual, we read that these meetings were on this occasion attended by from twelve to forty persons, who are styled by the reporters "electors;" the fact being that, beyond a few friends of the candidates, the attendance usually consists of loungers "who have no work to do," and who naturally drop in at every door gratuitously open, especially when the weather is cold, and contribute the loudest applause and the noisiest disapprobation. Of course, we should not have paid attention to anything said at these meetings, but, as a fact, the gas question was almost entirely passed over at them. Even the veteran gas agitators were silent on the matter, and it was, we rather think, at only three out of the twenty-four wards that a mild resolution was come to approving of the united action of the Metropolitan Board and Corporation to procure a cheaper and better supply of gas.

We may repeat, then, that the "public" are perfectly unconcerned in the matter, but they will not remain so when they are made clearly to understand the proposals of the two local authorities. There are, of course, a number of people who, like Mr. F. B. Firth, are anxious to confiscate the property of gas shareholders, but it is not a large class.

In every case of the purchase of a gas company by a Corporation, within our experience, the voice of what we will call the responsible classes has always been in favour of just and liberal terms; and when public opinion is fairly consulted in the metropolis, we are certain the result will be the same. There are very few who will have the effrontery to stand up and say that the metropolitan companies are to be dealt with on different principles than have governed the purchase at Glasgow, Leeds and Bradford, and other places. We have, after all, a much higher opinion of the Common Council and the Metropolitan Board of Works than to suppose that a majority of either authority, though we may be certain that there are very few holders of gas property among them, would resolutely persist in a scheme of confiscation. Like our correspondent, "Q. C.," we regard the purchase and competition Bills of the authorities as "shams," put forward to frighten the companies out of concessions.

We had no intention of making any further allusion to the pamphlet of Mr. F. B. Firth, who is on some points very ably dealt with by our correspondent. Perhaps the oddest notion put forward by the pamphleteer is, that the local authorities should have power to make a compulsory purchase, at a valuation of the plant of the companies under the streets. Then they could put the supply up to competition, or, if necessary, supply themselves. We may suppose a parallel case. A manufacturer has a workman who possesses a set of tools unique in their character. He pays the present owner of the tools 6s. per day; but if he can only, *per fas aut nefas*, get possession of the tools, he can find another man who will use them for 3s. a day. Is there an honest mind that would not revolt at the bare suggestion of such a proposal. And yet the suggestion is actually made to an enlightened and, we believe, at heart, honest commercial community.

There is another point not alluded to by our correspondent to which, in view of coming events, we may briefly refer. At page 48 of his pamphlet Mr. Firth comments on the premiums which newly-issued shares command. The Companies Clauses Consolidation Act provides that all newly-issued shares shall first be offered to existing shareholders, and if these do not wish to take them up, they may, of course, dispose of their interest at such a premium as the market will command. The writer argues that this premium is so much plunder, but what can be more unfair than the argument? If a purchaser is to be found who will be content to take 6 per cent., instead of 10 per cent., what can be more reasonable and just than that he should pay the capital difference to the proprietor who would be entitled to 10 per cent.? and how could the London ratepayer or gas consumer be prejudiced, who pays 10 per cent. on the nominal capital, but only 6 per cent. on the invested money? It is perfectly true that recent Acts put it in the power of the proprietors of three London gas companies to realize considerable premiums; but who is to blame for this? So far as we remember, neither the Corporation of London, in the case of the Chartered Company (1872), nor the Metropolitan Board, in the cases of the Imperial and South Metropolitan Companies, earlier, suggested an "auction "clause," such as the Corporations of Nottingham and other towns secured. We do not expect they would have succeeded if they had tried, but they never made an effort. It is absurd, then, now to complain of the effect of Acts of Parliament which they made no attempt to amend.

But Mr. Firth does not represent either the Metropolitan Board or the Corporation of London. He seems to have some respect for the latter, but evidently entertains none for the former. The action of the Corporation, he says, has been praiseworthy throughout; but the history of the past, he adds, should make any consumer decline to commit his interests to the keeping of the Metropolitan Board. The writer is one of the promoters of the scheme to hand over the gas supply of the metropolis to a body of commissioners, to be elected by somebody; but it is not made clear by whom. Vestries and District Boards are, no doubt, contemplated. Any scheme of purchase, he says, should receive the sanction of the Privy Council and the Corporation of London, the "unpatriotic" Metropolitan Board having no voice in the matter. But whenever that grand central municipal authority is constituted, the formation of which is to be advocated in the larger book by the author, forthcoming, the gas undertakings are to be handed over to them, with our full consent and approval, we may say, if only a legitimate price be paid.

As a site for storeage works, the engineers consulted by the Metropolitan Board, in drawing up their competitive scheme, have fixed upon a sort of Naboth's vineyard over in Battersea. There is there some parish land which has for many years been let out in allotments to deserving poor, who, in leisure hours, cultivate a few cabbages and other vegetables, and whom the Metropolitan Board propose to compensate with a lump sum of £50. But on this question of compensation we must quote the actual words of a local organ, the italics, it may be remarked, being ours:—

It does not appear to be a mere question of compensation to the present tenants, to whom the Board propose to give a lump sum of £50; but even if it were, as the land is let yearly, at a merely nominal figure, *the tenants in prospective ought also to be considered.* It cannot be doubted that the endeavour of the Metropolitan Board of Works to break down the monopoly which exists among the present private gas companies is a most commendable one, and that any reasonable attempt to provide the metropolis with both better and cheaper gas deserves hearty and universal co-operation; but the high-handed endeavour to acquire property of the nature of these Latchmere allotments, without in any way consulting the wishes or feelings of the inhabitants of so widely extending and—we use the term advisedly—important parish as Battersea, is certainly not to be countenanced, and we mistake the parishioners of Battersea if, with any power of agitation left, they thus quietly allow themselves to be divested of one of their oldest and best-used trusts.

We could not put the case of the gas companies more strongly.

The Lewisham Board of Works are still at enmity with the Phœnix Gas Company. It will be in the memory of our readers, that early in the present year the gas examiner of the Board reported 31·5 grains of sulphur per 100 feet in the gas made at the Greenwich station of the company. Thereupon the Board decided on taking legal proceedings; but, before the summons was heard, Mr. Heisch made another test, and found only 16·7 grains of sulphur in the gas. This evidence induced the magistrate to think that the company were doing their best to abate the alleged nuisance, and therefore recommended that the summons should be withdrawn, and his advice was acted upon. After this, the company forwarded to the Board quotations from a lecture by Dr. Odling, and statements by Messrs. Keates and Wills, made to the directors of the company, as outlines of the evidence they would give at the hearing of the case. These statements are, of course, intended to show that at the worst the amount of sulphur in gas is relatively exceedingly small, and that the product of its combustion (which the writers assume to be sulphurous acid) would be entirely innocuous if attention were paid to ventilation. On submitting these papers to the Board, the company expressed a desire to discuss the question with the Board, with a view to arriving at an agreement thereon, as provided by section 25 of the Metropolis Gas Act, 1860, under which local authorities and a gas company may agree as to the maximum amount of sulphur to be permitted. We gather that the Board decline to enter upon any negotiations with this object. They referred all their papers to their gas examiner, who sent a reply, which we publish in another column. It is our duty, of course, to give both sides of a question, and Mr. Heisch's report contains some facts which have not hitherto been published. Our own opinion on the sulphur question has been repeatedly expressed in these columns. The ill effects of sulphur in gas are often greatly exaggerated, but there is so much evidence of mischief resulting from its presence, as should induce gas companies to use every endeavour to reduce the amount to a minimum. Granted that the removal costs money, the public, who desire to have gas free from sulphur, must pay the cost, and we do not know that they would have any objection to do so. In any case, an obstructive policy on the part of a gas company is just now extremely objectionable. We see the Corporation and Board of Works declining to fix any limit in respect of sulphur when they propose to manufacture gas—a fact of which the Lewisham Board will doubtless make a note.

In the hasty reference we made to the Southgate accident in our last, we omitted to point out that the pipe must have been broken on the day of the explosion. If it had occurred the day before, it is certain that the inhabitants of the two houses would have been suffocated, and not blown up. Without reflecting on any one, we may be allowed to say that the technical evidence given at the inquest was not worthy of the gravity of the occasion. The coroner, it is clear, has something to learn as to the proportions which constitute the most dangerously explosive mixture of gas and air.

The curt reply made to a friendly suggestion offered to the Exeter Gas Company, obliges us to publish the report of Dr. Redwood, which was the foundation of our remark. We accept to the full the statement made by the secretary to the Town Council, but may nevertheless repeat our opinion, that the company might find it more profitable to manufacture sulphate of ammonia on the spot, than to send the liquor away to Plymouth by rail.

Exeter seems to be a place where gas consumers are not allowed to do as they like with their own. The Town Council will give a consumer permission to put a private lamp outside his house or office, but on the condition that this private lamp must be kept alight as long as the public ones. Some people do not seem to be pleased with this arrangement, and put out their lamps before they go to bed. Then the gas company appear to come down upon them, insisting that the lamps shall either be kept alight the stipulated time, or taken down. The motive for the stipulation of the Town Council is to make, wherever they can, a private lamp do duty for a public one, and hence the action of the gas company is natural.

Water and Sanitary Notes.

The prompt action of the Chelsea Water Company, on the receipt of Major Bolton's report, is to be highly commended, and we have no doubt they will be successful with the Bill to be promoted. The outcry against the turbid water supplied at the beginning of this month was out of all proportion to the gravity of the occasion; but then it must be remembered that it was raised in Belgravia, and a shriek from that aristocratic region creates a great sensation. It will be so far advantageous to the company, that they will now get powers which, if asked for under less exciting circumstances, would certainly have been refused. A change of intake is now certain to be made, but the expense will be very great. We have no doubt that the necessary works will be pushed with vigour as soon as the powers are obtained; but we fear that, notwithstanding all the efforts of the company, Belgravian beauties will, for another year, have occasionally to bathe in turbid water. They may remember, however, that for this they have to thank the House of Lords, who, in 1873, threw out the Bill of the company for reservoirs and works opposite to Hampton Court. We are rather at a loss to understand on what grounds Dr. Frankland so strongly condemns the use of this turbid water for dietetic purposes. There is, surely, no great harm in a little chalk and clay, of which, after all, the amount present is ridiculously small; and we question the wisdom of alarming people without occasion, and ministering to popular excitement.

The Acton Local Board have availed themselves of the section of the Sanitary Act of last session which authorizes a magistrate to order the closing of a pump the water of which is represented to be unfit for drinking and domestic purposes. The granting of the order was opposed by some who clearly saw that the next step taken by the Local Board would be to compel the owners of small properties to lay on a supply of water to their houses. For these pumps are, of course, chiefly resorted to by the poor, who, as the magistrate remarked, would probably suffer if the wells were closed. In the end, an order was granted, closing one out of three pumps for a month. A nice question is raised as to the duties of the Local Board, who are the custodians of the public pumps. Mr. Bridge evidently inclines to the belief that it is their duty to cleanse the wells and purify the water, if possible.

The Metropolitan Board of Works, who pass over almost without notice, and certainly without any expression of approval, the continued exertions of the water companies to give a general constant supply, and who further refuse to go to the expense of putting up hydrants where mains are already constantly charged, never hesitate to complain if a turncock does not turnup, like a fairy in a pantomime, just at the moment, and exactly at the spot where his services are required. So long, however, as the Board neglect their most plain and obvious duty, and refuse to co-operate with the companies to obtain a constant supply, there will now and then be a little delay in procuring water at a fire. The profound wisdom and practical sagacity of Mr. Runtz discerns an easy remedy. What is wanted, he says, is a "fire-main" in every street, always charged with water. Very good. Will the Board lay the main?

The water accounts of the Corporation of Leeds for the year ending Aug. 31, 1874, have just been issued. They show a profit on the year's working of £3851. 12s. 5d., which is about 6s. 8d. per cent. on the capital invested in the undertaking. This is not very much, but it still may be considered a satisfactory result. The capital now stands at £987,583. The total expenditure for the year was £52,323. 3s. 2d., and the receipts from water-rents £55,541. 10s. 3d., showing profit as above.

A TREATISE ON THE SCIENCE AND PRACTICE OF THE MANUFACTURE AND DISTRIBUTION OF COAL GAS.

XLV.

The Chemistry of the Manufacture and Purification of Gas.

In support of the belief just expressed that bisulphide of carbon is not a product of extreme heat, we may quote the opinion of Schilling, who says* that recent researches have proved that there is no more bisulphide produced at a high than at a lower temperature.

The production of carbonic oxide and carbonic acid has been alluded to before. They occur in all stages of the distillation, but probably most of the carbonic oxide produced in the retort is developed towards the end of the charge. At this stage, any carbonic acid formed will have to traverse a considerable thickness of incandescent coke, and in that way is made to take up an additional equivalent of carbon, which converts it into carbonic oxide.

Sulphuretted hydrogen is formed all through the duration of a charge, but most appears to be formed about the middle stage. It is at this time that the vapours of sulphur and water are under the most favourable conditions for its production. The sulphuretted hydrocarbons are bodies whose existence in gas is still doubtful. Mr.

* "Traité," &c., p. 64.

Kirkham has given strong reasons for a belief in their existence, since he has proved that a sulphur compound, or sulphur compounds, are present in the oils condensed upon the water of a gasholder. Some writers, however, speak of allyl in gas, and it may well be that a compound of this hydrocarbon with sulphur and an additional equivalent of hydrogen ($C_3 H_6 S$) is present in gas, a conjecture which is supported by the peculiar alliaceous or garlic odour which is sometimes observed in gas.

Ammonia and the alkaline bodies containing nitrogen, which are found in tar, and the oxygenated acids, are the only remaining ingredients in the raw products of the retort remaining to be accounted for. Dr. Letheby conjectures that these last are produced at a comparatively low heat, while ammonia, aniline, &c., are formed at higher temperatures. Strictly speaking, we know nothing about the formation of these bodies. They are probably produced at all stages of the distillation, but perhaps in the greatest degree at the middle stage. Whether such decompositions happen with those alkaline bodies when exposed to heat, such as it has been shown before corresponding hydrocarbons undergo, is at present unknown, and will remain unknown until the manufacture of gas has received such a thorough chemical investigation as its importance deserves.

From what has gone before, it is clear that the gas manufacturer has, under the present system, a very limited control over the changes which take place in the retorts. He has a choice of materials and a choice of heats, and beyond these it would appear that there is nothing to influence the composition of the gas but the action of the exhauster. In the large settings now generally adopted, scarcely two retorts can be maintained at the same degree of heat. The eye, probaby, cannot distinguish differences of less than 300° Fahr., and within these ranges vastly important changes may happen. Thus, the gas maker gets at the best but an average result of the workings at various heats. It is no doubt true, as conjectured by Dr. Muspratt, and believed by Mr. Leigh, that there is a temperature at which in the process of decomposition olefiant gas and volatile hydrocarbons should be formed, and which should yet be unable to decompose these into compounds poorer in carbon, the intensity of the decomposition being proportionate to that of the heat. Both the authorities quoted agree that such a temperature must be far below that generally employed in the manufacture of gas.*

The researches of Berthelot have been made since the above opinions were expressed, and his experiments show that the decompositions which happen are not altogether prejudicial. It is only when pushed to the last by the detention of the mixed gases and vapours under pressure in the retort, or when the heat is excessive, that real injury is done to the gas. The lower temperature spoken of by Leigh and Muspratt would, no doubt, produce a gas richer in condensable hydrocarbons (liquid), the advantages of which, beyond a certain and small amount, are not clear. On the other hand, the production would be smaller in quantity, and we should lose the presence of much hydrogen, which, though probably regarded as a diluent, is, nevertheless, of value in the gas.

The common experience of two generations of gas manufacturers seems to have settled decisively that the best heat for the production of gas from common coal is that which the eye recognizes as a "cherry red." As a point of much scientific interest, it is to be regretted that we have no accurate measurement of this temperature expressed in thermometrical degrees; but, practically, it is of no importance. The eye is a very satisfactory guide to the manufacturer.

Supposing, then, this heat effectually maintained in the retort, it seems clear that mischief can only arise from two causes—1, the prolonged contact of the gases and vapours with the walls of the retort; and 2, the nascent gases having to pass through a thick stratum of incandescent coke. The remedies are evident.

But gas manufacturers have not only to make gas, they have to make gas-works pay; that however is a branch of our subject which it would be out of place to discuss here.

(To be continued.)

* Muspratt's "Dictionary." Art. Gas, vol. ii., p. 132.

Review.

Air as Fuel; or, Petroleum and other Mineral Oils utilized by Carburetting Air, and rendering it Inflammable. By OWEN C. D. ROSS, M. Inst. C.E. London: E. and F. H. Spon, 1874.

"Air as Fuel" is a very taking title. It suggests that we may warm our houses and boil our kettles by the help of the north wind. And so we may, if we only carburet it under the directions of Mr. Ross. It is, however, a question how far air can be considered as a "combustible." It may possibly be correct to say that oxygen is as much burnt as carbon in the ordinary process of combustion. But the greater part of atmospheric air consists of a gas which is simply obstructive in its action, taking no part in the changes, and absorbing much heat. Mr. Ross hazards "the suggestion that, if we were accustomed to speak of the process of combustion as one in which air is the principal and carbon and hydrogen only the auxiliary elements—if we were to say that we burn air, instead of saying that we burn wood or coal—it would not only be equally accurate, but such a definition would be found to lead to a clearer and more easy comprehension of the conditions under which heat can be most advantageously obtained."

There is so much truth in this—that most undoubtedly the thermal effect of fuel depends on the air supply, the access of too little or too much resulting in manifest waste. The difficulties in the way of accurately adjusting the supply of air to what we may call the *needs* of ordinary fuel are perhaps insuperable. But Mr. Ross contends that it is easy to give to air such an amount of petroleum vapour as will bring about the perfect combustion of the carbon and hydrogen, and thus the maximum thermal effect will be ensured. He shows, in fact, that "the calorific power of petroleum, as compared with coal, is more than double, but when burned as a thin vapour, mixed with air previous to its admission to a boiler furnace, it will practically generate four times as much steam as coal [weight for weight], owing to its being completely consumed, and to the diminution in volume of hot products which escape to the chimney." We shall not follow the author through the calculations by which he establishes his proposition. They are no doubt quite correct; but we wish that the author had given in addition the results of practical experiments with his method.

We quite agree with him that the Woolwich experiments, in 1866 and 1867, were altogether inconclusive. Those made with locomotives on the railway between Paris and Epernay, an account of which has been given in the JOURNAL OF GAS LIGHTING (vol. xix, page 45), were more satisfactory, but then the use of petroleum as fuel has been discontinued. But neither at Woolwich nor in France was the fuel such as the author proposes to use. He has a sort of model petroleum, on which all his calculations are based. It has the composition $C_{11} H_{24}$, and the specific gravity 0·655; its boiling point is 126° Fahr., and the vapour density 2·85. We have never had the opportunity of experimenting with a spirit of exactly this character, but we have no doubt that, used in the author's method, it would produce all the thermal effect he describes, or calculates upon. But when he comes to the manufacture of illuminating gas, we must express a speculative disagreement with him. The vapour of one gallon of this spirit in 500 cubic feet of air would, we venture to think, produce a mixture having a very low illuminating power, useless, in fact, for illuminating purposes, unless burnt under conditions not as yet attainable. Double the quantity might, perhaps, if burnt at the ordinary rate, give the light of 12 or 14 candles, but more could not be expected. As a fact, these petroleum spirits, in which the proportion of hydrogen so far exceeds that of carbon, are not well adapted for the production of light when burned with mixed air. They are too rapidly consumed, and the temperature of the flame is kept down by the nitrogen. To obtain the maximum luminiferous effect, they must be burned with a wick.

We say, subject, of course, to correction, that no air-carburetting process for illuminating purposes has been permanently successful. When Mr. Mansfield's experiments are referred to, as they so frequently are, it should be remembered that his carburetting material was nearly pure benzol ($C_6 H_6$), a very different body to our author's model hydrocarbon ($C_{11} H_{24}$).

With all Mr. Ross says with regard to the permanence of the vapour dissolved, we may say, in air, we perfectly agree. It is now well established that a given quantity of petroleum vapour mixed with air will travel to any distance, and remain uncondensed at any temperature to which it is likely to be exposed.

Notwithstanding this, we are under no alarm that carburetted air will ever supersede coal gas. It must be said that Mr. Ross nowhere asserts that it may. Petroleum vapour, we have little doubt, will prove a valuable auxiliary, to the extent that gas producers may save the use of expensive cannel, and profitably employ poorer coals than now find a sale in the gas market. But further than this, and the possible decomposition of petroleum to yield a really permanent gas, we see no prospect. While waiting for the solution of this important problem, we commend this book to the serious attention of every one who feels an interest in the use of the petroleum spirit, whether for the production of heat or light.

Correspondence.

MR. FIRTH'S PAMPHLET ON THE GAS SUPPLY OF LONDON.

SIR,—As a gas shareholder, and, therefore, interested in the threatened proceedings of the Metropolitan Board of Works and the Corporation of London against the interests of the different gas companies supplying the metropolis, I have read with some amusement the arguments put forth in a pamphlet recently published, under the name of Mr. F. B. Firth, in support of those proceedings. The author would appear, by his writing, to be a gentleman animated by about an equal amount of hatred of the gas companies and of the Metropolitan Board of Works, of whom he observes, not unjustly (p. 67), that "*any consumer of gas would decline to commit his interests;*" so that, if this be so, one would think that this should be a sufficient argument against the bills which they propose to introduce for purchasing the works of the gas companies, or for enabling them to afford an independent supply in competition with them.

The author is, nevertheless, a strong advocate for taking the supply out of the hands of the companies, and of compelling them to sell their works at prices not proportioned to their productive value in the hands of their present owners (which, I presume, would be a fair principle of valuation), but an easier principle to be invented for the occasion, and more favourable to the purchasers.

He gives, it is true, a variety of instances in which (as in the case of Glasgow and other places) the works of existing gas companies have been purchased by local public authorities, either by agreement or under the decision of parliamentary committees, on ordinary terms of fair dealing to the shareholders, and which have been attended, as he admits, with very favourable results to the purchasers, but he thinks it would not be so advantageous to the consumer to adopt these precedents as to establish a new one less favourable to the vendor. Indeed, he goes so far as to advocate (p. 65) the propriety of allowing public bodies to purchase, at a valuation, from the gas companies, their *pipes and plant* UNDER *the streets*, leaving them thereafter to purchase the manufacturing works connected with them or not, as they may think fit, observing "that once in possession of the *pipes*, they might put up the supply to public tender, and, if they disliked the prices tendered, establish manufactories for themselves."

The principles of fair dealing which actuate this gentleman may, be, therefore, fairly judged of by the foregoing observations, and his notions of the inviolability of parliamentary contract may be further judged of by the principle enumerated by him (in p. 44), "*that the same Parliament which makes a contract can repeal it.*"

Thus, according to this gentleman, if a company is willing to undertake certain obligations towards the public, subject to corresponding

advantages to themselves, and to advance large sums of money on a bargain to this effect, made between them and the representatives of the public in Parliament, it is in the power (consistently with justice) for these latter, in a subsequent session, to repeal all the conditions of advantage on which these sums of money have been subscribed, leaving the obligations on those who advanced them as they were—*but, of course, in the interest of the public!*

Verily, if this principle were allowed to prevail in this commercial country, where hitherto, fortunately, fair dealing has been the rule, I cannot help thinking that, in the end, the public would be the largest sufferers, for no one hereafter would willingly subscribe to any undertaking based upon the sanction of a British Parliament.

The pamphlet to which I have referred is full of exaggerations, suppressions, and fallacies of all sorts, affecting the positions, the rights, and the past conduct of the gas companies, which it would be needless, and would occupy too much of your space, to expose. Suffice it to say, that they are all intended to support the dishonest argument—that the property of these companies, established, as it is, on the sanction of Acts of Parliament deliberately passed, after full hearing of all that the public authorities could advance in support of their interests, should now be to a certain extent confiscated, in order that those public bodies may become possessed of the undertaking sbelonging to them, now that their profitable character has been established.

It can hardly be supposed that committees of the House of Lords or Commons, by whom the Acts have been passed, establishing the rights of the companies, and their corresponding obligations to the public, and who are generally actuated, as gentlemen of honour, by principles of fair dealing, will listen to arguments such as those to which I have referred.

So far as I know, the metropolitan gas companies have never refused to sell their undertakings on fair terms, such as have met with the approval of Parliament in other cases; but on what principle, it may be asked, should they be dealt with differently from the companies who supplied Glasgow, or Leeds, or Bradford, or any of the other towns to which the pamphleteer refers?

If the Board of Works and the Corporation of London are *really in earnest* in their desire to become possessed of the London gas-works on fair and equitable terms, I dare say they will find no difficulty in obtaining them; but it would appear from their proceedings, as published in the newspapers, that they are by no means willing to submit the terms of purchase to a fair and equitable tribunal, but only to take them on their own terms, which would give about six per cent. to the shareholders who are now receiving ten.

In truth, the two bills introduced by these bodies—the one for the purchase of the existing undertakings, and the other for enabling them to afford an independent supply—are simply *shams*, and promoted solely for the purpose of screwing terms out of the gas companies.

How far this may be consistent with common honesty and fair dealing towards their fellow-citizens, and how far it may be consistent with their own position as public bodies representing the great commercial community of London, I leave to others to determine. As between man and man, a similar course of proceeding would affix to him who should adopt it, a term which I will refrain from expressing.

It is not needful that I should point out in much detail the position which the gas consumer would hold if the supply were in the hands of the Metropolitan Board of Works, as compared with that which he now enjoys; but it may be as well to point his attention to the fact that every precaution which ingenuity could devise has been adopted for securing to the public, by the Acts of Parliament relating to the companies, gas of the greatest purity, of the highest illuminating power, and at the lowest price at which it can be manufactured and sold, consistently with a fair trading profit to the manufacturers; and that these latter are not only authorized but compelled to furnish gas to all customers within the districts confided to them.

Contrast this state of things with that which is proposed by the bill of the Metropolitan Board of Works, wherein we find neither limitation of price or purity, nor any provisions, such as are inserted in the companies Acts, for testing the illuminating power or quality of the gas supplied, or imposing any penalty for its being deficient in either; so that the public would be actually at the mercy of the suppliers, instead of protected as they now are, in the case of the gas companies, against any infractions of their Acts of Parliament, whether in regard to price, purity, or illuminating power.

Moreover, as regards price, it will be found (as admitted by Mr. Firth in his pamphlet) that all the municipal bodies who have become gas manufacturers have found themselves compelled to raise their prices—as the London companies have done—owing to the late increase in tha cost of coals and labour; and though he instances Manchester as an exceptional case of successful management, it would appear that the corporation of that town so work their undertaking (being under no control as to price, purity, or illuminating power) as to *make* it pay 10 per cent., whilst it is well known that some of the London companies are limited in the aggregate to a dividend of only *eight per cent.!*

True it is that the profits of the undertaking are applied, in Manchester, to the reduction of local rates; but the result is, that a large gas consumer has thus to contribute towards the rates of others who may not consume gas at all.

This, it is said, is not the principle proposed to be adopted by the Board of Works if they should be entrusted with the supply of gas in London, neither, as merely a gas shareholder, am I interested in discussing the question of its propriety.

All I seek to establish is, that the gas companies having expended large capitals in the establishment and conduct of their works, orginally at great risk and loss to themselves, and subsequently under limitations of dividend and price, and subject to various conditions imposed on them by Parliament in the public interest, cannot justly be called on to sacrifice that dividend without a full and fair equivalent, unless it can be distinctly shown (which I firmly believe that it cannot) that they have failed to fulfil their obligations to the public.

Q. C.

THE LEWISHAM DISTRICT BOARD AND THE PHŒNIX GAS COMPANY.

SIR,—I beg to inform you that, proceedings having been taken by this board against the Phœnix Gas Company for supplying gas considerably below the standard of purity required by the Metropolis Gas Act, 1860, an application was made by the company to the board to agree upon a reduced standard of purity, under the provision of the 25th section of the Act, and such application has been referred by the board for the consideration and report of Mr. Heisch, their gas examiner. On his report the board have declined to accede to the application. As this question is one of considerable interest, I send you a report on the matter, which has been printed by the order of the board.

SAMUEL EDWARDS, Clerk to the Board.

The Board of Works for the Lewisham District, Dec. 22, 1874.

ON THE EFFECTS OF SULPHUR IN GAS.

Report of Mr. Heisch to the Lewisham District Board of Works.

Gentlemen,—I have carefully considered the various documents transmitted to me by your orders concerning the sulphur in the Phœnix gas, and beg to report thereon as follows.

I would first remark that the lecture of Dr. Odling is of somewhat old date, and that in a lecture delivered before the Association of Gas Managers, some years later, on a kindred subject as the one sent you, none of the statements therein contained are reproduced. The outline of Mr. Keates's evidence is mainly taken from a paper written by him many years ago, when he was consulting chemist to the City of London Gas-Works. Mr. Wills was for some time Dr. Odling's assistant, and what he says is mostly a copy of Dr. Odling's statements.

The subject may be considered under three heads:—

1. Is an excess of sulphur injurious?
2. Can the sulphur be removed?
3. Will its removal create a nuisance?

1. The evidence of Dr. Odling, Mr. Keates, and Mr. Wills is, for all practical purposes, the same, and is founded on an error which would have been exposed by a few minutes cross-examination by a well-instructed counsel.

All three gentlemen speak of the result of the combustion of the sulphur in gas as sulphurous acid gas. When sulphur is burnt in dry air, or dry oxygen, this gas is produced, but when burnt even in a slightly moist atmosphere, part is converted into sulphuric acid, and, when burnt with a large quantity of hydrogen (as in coal gas), the oxidation of which produces water in large quantities, the amount of sulphurous acid formed is quite insignificant, nearly all the sulphur being converted into sulphuric acid—not a gas, but a vapour, readily condensed on all the walls of, and articles contained in, a room, and most difficult to remove, even by a strong draught through the room, much less by the ordinary means of ventilation. Even if the sulphur, as it issues from the burner, were in the state of sulphurous acid, in the presence of the quantity of water simultaneously formed, it would be oxidized into sulphuric acid long before it could be removed from the room, and the corrosive and destructive effects thus go on accumulating. That such is the fact the experience of every one who notices the effect of burning gas on metal articles, plants, &c., abundantly proves. Let me now set against the statements of Messrs. Odling, Keates, and Wills the following statement of what experience proves to be the fact. Each grain of sulphur, in burning as it does in gas, gives rise to the production of just over 3 grains of sulphuric acid; 100 cubic feet of gas, if it contain 30 grains of sulphur (a very common amount), would in burning produce 90 grains of sulphuric acid, and three burners, each burning 4 cubic feet per hour, would produce between 3 and 4 grains of sulphuric acid per hour, or about 20 grains in six hours, which would in great part be condensed on the contents of the room in which the gas is burnt. Such a process repeated every day fully accounts for the destruction which occurs when gas is burnt. I may remark, in passing, that carbonic acid and water are both as much produced by any other light (oil lamps, for instance) as by gaslight, yet the same destructive effects are not produced. Any one who will take the trouble to examine the corrosion occurring on metal work where gas is burnt will find it to consist of sulphate of the metal. All tradesmen are only too well acquainted with the rotting effects produced by gas on their goods. One most instructive instance in proof of the above assertion I may mention. Some years since gas was introduced at the Royal Observatory in place of camphine lamps for the photographic registration of magnetic variations, &c. In a very short time the surface of every reflector was destroyed, and the draw-tubes of the telescopes quite corroded. It was found necessary to place a tube over each burner, and to connect all these with a central chimney in which a strong draught was maintained to carry off the products of combustion. These tubes were, for cheapness, made of zinc. In a few days all the lamps were found extinguished by a crystalline substance which dropped on the burners from the tubes. This proved to be sulphate of zinc. I recommended the substitution of tinned copper tubes, but the price was objected to, and a contrivance was resorted to by which the condensed matter was run into a vessel at the side of the chimney. In one of these vessels I collected, in six weeks, from a burner consuming about half a foot per hour ¾ lb. sulphate of zinc. In this case unusual means were used to carry off the acid in the state of vapour, but with what effect the result showed. This result fully confirms all the statements made by bootmakers and others of the rotting effects of the products of gas combustion. It will be observed that at the Observatory there was simply the substitution of one combustible for another (gas for camphine), no greater number of burners being employed after gas was introduced, and the flames of both the gas and the camphine being of the same size. Carbonic acid and water must have been as abundantly produced by the camphine as by the gas, yet no ill effects were produced, though it was burnt for at least a year, while a week sufficed to show the destructive effects of the gas. Dr. Odling makes much of the difference between gas burnt slowly and at the ordinary rate, and might, perhaps, attribute some of the above results to the smallness of the flames employed. If so, I would reply, that as these flames were required to give as much light as possible, the supply of air was certainly not more abundant than in an ordinary gas-flame; so that no greater amount of oxidation was likely to take place. I will further state, that I examined the liquid which condensed in the pipe of a gas stove burning 7 or 8 feet per hour, and found that it contained large quantities of sulphuric acid, and was very corrosive, at least as much so as that produced by the small flame. It will be observed that neither of the three gentlemen quoted by the gas company produce any practical proof of their assertion that sulphurous acid gas is the product of the combustion of the sulphur in coal gas. I have searched for it in vain, while the sulphuric acid is always abundant. Dr. Odling's theory that the air contains ammonia enough to neutralize all sulphuric acid formed, even if true, of very crowded rooms, is certainly not so of ordinary sitting-rooms.

I would call especial attention to Dr. Letheby's reply to Dr. Odling, reported in the same JOURNAL* as the lecture, showing that even at that time practical men did not agree with his theories.

2. Can the sulphur be removed? The best answer to this is, that at the present time the gas with which the City of London is supplied contains on an average only 12 grains of sulphur per 100 cubic feet. That which for many years was supplied by the Great Central Company contained even less. The question of what can be done with the present plant of the company is not one on which I think we are bound to enter. In 1860 the company entered into an agreement to supply gas containing only 20 grains of sulphur to 100 cubic feet, and during all the succeeding years they might have quietly made the necessary alterations in their plant without any undue pressure; that they have not made the attempt to carry out their agreement is no reason for now sparing

* JOURNAL OF GAS LIGHTING, vol. xviii., p. 81.

them. The assertion that the Act of 1860 has never been acted upon is only partly true. The City took action against one of the companies supplying it, shortly after the Act came into full operation, and Dr. Letheby (the gas examiner to the City at that time) was prepared with abundant proof of the corrosive effects of the sulphuric acid generated. The case, however, fell through, owing to its being ruled that the aldermen were the only magistrates in the City, and thus prosecutor and judge were virtually the same person, which could not be permitted. This defect of jurisdiction alone prevented the Act of 1860 being enforced. Before concluding this part of the subject, I would add that the metropolitan gas referees, in their sulphur report, 1872, state that they are now sure that lime, properly used, is a perfect means of taking out the sulphur from gas, and that its removal can be effected with as great certainty as that of ammonia or sulphuretted hydrogen.

3. Does the removal of the sulphur necessarily produce a nuisance? That if the purifiers be simply opened and emptied, a nuisance is produced, no one can doubt, but that it is impossible to prevent it is not by any means proved. Dr. Letheby (the consulting chemist of the Phœnix Company) has repeatedly said that it is not, and most chemists will agree with him; trouble and expense it may cause, but the result is worth the cost. Any one observing the difference in the destructive effects of the gas now supplied to the City and that which was supplied three years ago, or is still supplied to many places outside the City, will have no doubt on this point. The present metropolitan gas referees, though more lenient to the gas companies than their predecessors, permit 25 grains of sulphur in gas made at urban works, only for a time, till the requisite alterations are made, so that they, even, manifestly do not admit the impossibility of the removal of the sulphur without producing a nuisance, if proper means are taken to prevent it.

CHAS. HEISCH, F.C.S., Superintending Gas Examiner to the
Nov. 4, 1874. Corporation of the City of London.

Legal Intelligence.

WORSHIP STREET POLICE COURT.—THURSDAY, DEC. 24.

(*Before Mr.* BUSHBY.)

SUMMONS FOR CUTTING OFF GAS.

The *Commercial Gas Company* were summoned by William Scott, landlord of the Blue Anchor public-house, Whitechapel Road, for not supplying gas.

Mr. DOUGLAS STRAIGHT appeared for the company, and Mr. KIDD conducted the case for the complainant.

The complainant deposed that he had been supplied by the company in question since 1873. He had paid up to October last, but on the 12th of December the gas was cut off without a notice being given. On the 8th of December a demand was made upon him for £11 odd for gas.

Mr. STRAIGHT said the same notice contained an intimation that if the amount was not paid within 24 hours the gas would be cut off, and all piping, meters, &c.

Mr. BUSHBY remarked that that was all that was required by the Act of Parliament.

Mr. STRAIGHT, for the defence, said that though little sympathy might be felt for gas companies, yet as public-houses frequently changed hands they might be excused for sharp dealing. The company were willing to supply gas if the security was found as they were entitled to demand.

Mr. BUSHBY suggested that some arrangement should be come to. The company were wrong not to give the notice requiring security, and not having done so, they had put themselves in the wrong by cutting off the gas.

In the end an adjournment was taken for settlement, the complainant meanwhile to give security for £5, and the company to put on the gas, without prejudice in the event of their coming into court again for the magistrate's decision.

HAMMERSMITH POLICE COURT.—TUESDAY, DEC. 22.

(*Before Mr.* BRIDGE.)

FOLLUTED WATER AT ACTON.

Mr. HEMSLEY, clerk of the Acton Local Board, attended in reference to three summonses adjourned from the 24th ult., which were issued at the instance of the board for the closing of three pumps in their parish. He said the proceedings were taken under the Act of last session, which enabled the magistrate to grant orders for the closing of the pumps. On the former occasion he withdrew the summons in the case of the Steyne pump. With respect to the Thorney conduit pump he read the report of Dr. Voelcker, who was appointed by the magistrate to analyze a sample of the water, and it stated that the water was decidedly unfit for drinking and domestic purposes. He (Mr. Hemsley), therefore, asked the magistrate for an order, as he knew of nothing to meet the case except the closing of the pump. With respect to Brentford Lane pump there was a difference of opinion. Mr. Bridge read this part of the report, which stated that the sample of water was not contaminated with an amount of injurious drainage product as to render it unfit for drinking and general domestic purposes.

Mr. BROWN, who represented the rector of Acton, said the Thorney conduit pump had been in existence 200 years. He asked the magistrate before he made an order, to consider earnestly what the consequence must be to a number of poor people who had used the water for years. Assuming the report was correct, he submitted that it was the duty of the board to remedy the evil, and if not, to place a drinking fountain, or some other water supply, in the place of the pump. As the board were custodians of the pumps, it was manifestly unfair to order them to be closed.

Mr. BRIDGE said he quite agreed that the pumps ought not to be permanently closed until some steps had been taken to try to render the water fit to drink. He certainly should stretch his power to preserve the poor from being deprived of the use of the water.

Mr. HEMSLEY thought the existence of the wells was detrimental to the poor, as they induced landlords of small houses not to put on a water supply. If the wells were stopped up, the landlords would be compelled to put on a water supp y to their houses.

Mr. BRIDGE said that if well water was pure it was far better than water supplied from the river. He should not order the old well to be closed unless it was shown that the water could not be made pure at a reasonable cost. He should make an order for the pump to be closed for one month, and at the end of that time he should require evidence that there was no means of purifying the water.

Mr. HEMSLEY said the board would be in the same position at the end of the month. The expense would be too heavy for the board to undertake.

Mr. BRIDGE thought there could not be any difficulty in the matter. He ultimately made an order for the pump to be closed for two months. The other summonses were withdrawn.

ASTON PETTY SESSIONS.—WEDNESDAY, DEC. 23.

(*Before the Rev.* W. K. R. BEDFORD *and other Magistrates.*)

PROSECUTION OF GAS STOKERS FOR NEGLECT OF WORK.

Eleven men in the employ of the Birmingham and Staffordshire Gaslight and Coke Company appeared in answer to summonses taken out against them by the manager of the company, charging them with wilfully and unlawfully neglecting their work on various days between the 12th and 15th inst.

Mr. MOTTERAM, who appeared for the company, said the prosecution was instituted under the Master and Servants Act, 1867, and the defendants, who were respectively engaged in the capacity of gas-stokers, coke-wheelers, and general labourers, were charged with committing a breach of contract, by wilfully neglecting their work without notice or permission. The company, although anxious to avoid any apparent harshness towards their *employés*, felt themselves bound to take the present course, in order to protect themselves and the public. Lately a large number of men had neglected their work, and the prosecutors in consequence had been subjected to great inconvenience and expense, because it was found almost impossible to keep up a proper supply of gas, both in quantity and quality. The defendants, on entering prosecutors employment, had contracted to serve them faithfully, and for a certain time, and that their dismissal or withdrawal from the prosecutors service should be subject to a certain term of notice. Defendants had broken their contract by stopping away without notice or authority, leaving their work neglected, or by not coming at the proper time to take their turns. To supply their places in their absence incompetent men had to be engaged, and great loss was sustained.

Four or five witnesses were then examined in support of the summonses, and proved that the defendants had each signed a contract with the company on entering their service, and that they had wilfully broken the contract.

In answer to the summons, several of the defendants pleaded that they were prevented through illness from attending to their work, and the others stated that they were called away to visit sick relatives, and that they "put men on" to do a first turn, and they went themselves to take a second turn, but were too late.

Mr. MOTTERAM explained to the Bench that the men could have leave of absence by making a proper application for it, and giving proper notice.

Mr. BEDFORD said the magistrates had given the case very great attention, and they considered that it was their duty to teach the defendants, as well as all men in similar employments, that they could not unlawfully absent themselves and neglect their work with impunity. Defendants, if they wanted leave of absence, ought to have made proper application for it, and have given legal notice. They would be each fined 10s. and costs, amounting altogether to £1 4s. 6d., or fourteen days imprisonment, with the exception of Poole, who would be fined 5s. and costs. Latham was also fined 10s. and costs for a similar offence on the 15th inst.

Miscellaneous News.

METROPOLIS GAS SUPPLY.

METROPOLITAN BOARD OF WORKS.

At the Meeting of the Board on Wednesday last, the Works and General Purposes Committee brought up a report, stating that the committee had authorized the architect to obtain additional assistance, at a cost of 150 guineas, in the valuation of the sites proposed to be acquired for the erection of works for an independent supply of gas, and recommending that the course taken be approved.

Mr. NEWTON objected to the proposed outlay as unnecessary for the present; but it was urged that there were about 700 acres to be valued, and the time for doing so was limited.

The report was adopted.

A letter was read from the vestry of Battersea, to the effect that the piece of land in the parish, which the board are seeking power to acquire for the purposes of gas-works, is vested in the churchwardens and overseers in perpetuity, in trust for the poor of the parish; and urging the board to amend their bill, so that the land may be preserved for the benefits of the poor.

The communication was referred to the Parliamentary Committee.

METROPOLIS WATER SUPPLY.

Major Bolton's report on the supply of water to the metropolis during the month of November states that the condition of the water in the river Thames at Hampton, Molesey, and Sunbury, where the intakes of the West Middlesex, Grand Junction, Southwark and Vauxhall, Lambeth, and East London Companies are situated, was generally good throughout the month. The highest flood state of the river at Hampton during the month was 12 inches above the (6 feet) summer level, and the lowest 2 inches below. At Ditton the state of the water in the river was good on 7 days, indifferent on 11, and bad on 12 during the month, the bad water being attributable to the rivers Mole and Rye. On the 29th and 30th the river was in a state of flood, the water being excessively thick, turbid, and discoloured. The Chelsea Company is now the only one whose intake is below Hampton Court Bridge. The highest state of the flood water at this place was 2 feet 1 inch above, and the lowest 5 inches below summer level. The highest temperature of the water during the month was 52°, and the lowest 38°, while the highest temperature of the air at the same place was 57°, and the lowest 27°. These observationns were made daily at 9 a.m. The rainfall during the month was 1·61 inches. The water at the intake of the New River Company was generally good during the month, but towards the end was affected by floods, during the prevalence of which the intake is closed. The East London Company possess such ample impounding reservoirs that their supply is not affected by floods. The construction of additional subsiding reservoirs by the Southwark and Vauxhall Company is most desirable. The West Middlesex Company have extensive works and additional engine power of 120-horse power in course of construction at Hampton. This company, having large reservoir capacity, avoid taking in water when floods prevail. The Grand Junction Company need additional impounding reservoirs so as to avoid the flood waters. The Lambeth Company have completed the extensions and improvements in their works at Molesey. Additional engine power is about to be erected both at Ditton and Brixton works, a 24-inch main, 3 miles in length, is being laid to convey more water from Brixton to the centre of the lower district, and a reservoir at Norwood will be shortly commenced to serve the intermediate level between Rock Hill and Selhurst. This company are giving constant supply by means of stand-pipes in a number of courts and alleys. The alterations in fittings under the Board of Trade rules and regulations are being gradually effected as occasion offers, and are carried out in all new buildings. The marked improvement in the quality of the water supplied by this company is due to the completion of the new works at Molesey, where the impounding reservoirs are capable of holding fully 10 days supply, thus enabling the company to select the times of pumping when the river water is in the best condition, and consequently avoid taking in dirty water. A comparison of the state of the water at the intake at Ditton with the water at the intake at Hampton as above mentioned, will show the great disadvantage at which the Chelsea Company is placed as to the quality of the water it has to deal with, and points out how desirable it is that the site of the intake should be changed to a point above Hampton Court Bridge, and beyond the influence of the filthy outflow of the rivers Mole and Rye. This company have at present no impounding reservoirs whatever, having recently altered their reservoirs into filters; they are, therefore, necessarily compelled to take in their water as they find it, day by day, and without subsidence it is quite impossible to filter the water during the time of floods effectually. The immediate carrying out and completion of the works by the removal of the intake and the construction of suitable reservoirs, as recommended in 1872, and since frequently advocated, cannot be too strongly urged. The filtering of the metropolitan water supply has been lately much improved by the extension of the area of the filters, and by a slower rate of filtration being observed; it is most desirable that the rate of filtration should not exceed 2½ gallons per square foot of filter-bed per hour; this will give 540 gallons per square yard each 24 hours, and at this rate filtration should be effectual. The Act of 1871 provides power to compel the companies

to give constant supply as and when the public authorities may see fit to move. The companies that have moved in the matter and are giving constant supply under the provisions of the Act, in a portion of their districts, are the Kent and East London, as mentioned above.

SUPPLY OF WATER AT FIRES.—At the meeting of the Metropolitan Board on Wednesday last, the Fire Brigade Committee made the following report:—"Your committee have to report that they have considered the letter from the vestry of Kensington, referred to them on the 11th inst., calling attention to the delay in obtaining a supply of water at a recent fire in Finborough Road. Your committee have received a report from the chief officer stating the circumstances of the case, from which it appears that, although the delay was not quite so long as stated in the letter from the vestry, namely, one hour, still there was a considerable lapse of time after the arrival of the engines before water could be obtained. The engines had to wait twenty-five minutes, and the time from the first outbreak of the fire until water was procured was forty minutes. This is only an instance, rather more prominent, perhaps, than usual, of what occasionally takes place under the present intermittent system of water supply. As your committee have often stated, there appears to be no way of entirely avoiding the possibility of such occurrences, except by the establishment of a constant supply of water at high pressure. The reason why the firemen, although provided with keys of the plugs, are unable always to secure water for themselves, is, that the different water-mains are only charged for a short period during the day, and that when one main is charged, the water is usually shut off from the others. This takes place at variable hours, and, as a consequence, the firemen are never able to tell what mains are charged. It has occurred to your committee that, although a complete remedy for the state of things complained of can only be provided by the supply of water being made constant, the grave inconveniences of the present system might to some extent be lessened if the water companies were so to arrange their supply as to charge the different water-mains at fixed hours of the day, and to make the fire brigade acquainted with the arrangements made. If this were done, the fire brigade would probably be able, upon arrival at a fire, to know what mains in the neighbourhood were charged, and to obtain a supply of water for themselves immediately, without waiting for a turncock. Your committee have directed that a communication be addressed to the water companies, asking them to consider whether some such course could not be adopted." Mr. Thompson, in moving the adoption of the report, said the water companies had been written to respecting the supply of water, and the committee hoped to get some information from them as to what mains were charged at certain times and that facilities might be afforded to the brigade men to turn on the water without delay. As to the fire-escapes, they were locked up during the day, and therefore were not so accessible as at night, and delay was occasioned in consequence. The committee very much regretted the delay which had occurred in this instance. After some conversation the report was adopted.

CHELSEA WATER-WORKS COMPANY.

Intermediate Report by the Water Examiner appointed under the Metropolis Water Act, 1871, on the Results of a Special Inquiry into the Causes of the Turbidity of the Water supplied by the Chelsea Water-Works Company, between the 1st and 19th of December, 1874.

The inquiry which forms the subject of the following report relates to the turbid and ineffectually filtered water delivered from the mains of the Chelsea Water-Works in their district since the 1st of December, 1874.

Having inspected the intake of this company at Seething Wells, near Kingston-upon-Thames, on the 30th of November last, I found the river rising, and rapidly becoming very turbid. The water which was being taken into the filter-beds was thick and muddy, and the water in the wells of the filters, which had been clear and bright during the month, was slightly opalescent and discoloured.

I called the attention of the engineer in charge of the works to the turbid state of the river, and also to the water in the filter-wells, and pointed out the necessity for the greatest care being exercised in passing the water through the filter-beds.

I then proceeded up the river, and found the rivers Mole and Rye in a filthy and turbid state, discharging large quantities of clay and marl into the Thames, and causing the water in the river to become exceedingly turbid and polluted. Above Hampton Court Bridge the water was clear as compared with that which was mixed with the muddy outflow from the Mole, thus showing the advantages derived by all the other water companies, who have their intakes above the influence of these small but dirty streams.

On the 1st and 2nd of December the Chelsea Company delivered to their consumers slightly turbid water, on the 3rd and 4th it was much worse, while on the 5th it was so bad, and had such a repulsive appearance, that I proceeded to the office of the company with some samples, and informed the secretary that I intended to make a special report to the Local Government Board that the company were not effectually filtering the water being supplied by them, as required by the Metropolis Water Acts of 1852 and 1871.

The secretary admitted the bad state of the water, and informed me that a special meeting of his company was called for the 18th inst., when the subject of the change of intake and the construction of suitable impounding reservoirs would be specially considered.

I then made the following report to the Local Government Board, dated the 5th of December, 1874:—

"As water examiner appointed under the Metropolis Water Act of 1871, I have the honour to report that the Chelsea Water Company have been for the last few days, and are at present, supplying water of a very turbid character, and apparently ineffectually filtered.

"I beg to forward herewith a sample of the water as supplied by this company in Westminster this day, contained in an ordinary Winchester quart bottle, which fairly represents the quality of the water as delivered since the 2nd instant. The turbidity of the water will at once be seen by looking through the 24-inch glass tube, also containing a sample of the same water, which I send with the bottle.

"Under the 35th section of the Metropolis Water Act, 1871, 'the board may at any time, if and when they think fit, appoint a competent person to inquire into and report on the quality of the water furnished by any company,' and I beg to submit that I consider this a case where the quality should be inquired into by an analyst, and an analysis furnished for the information of the board.

"I would also respectfully suggest that the governor and company of the Chelsea Water-Works should be immediately communicated with, and requested to afford the board an explanation of the cause of the extremely turbid state of the water they are at present supplying to their district, and also that their attention should be called to the frequent periodical and special reports that I have made, pointing out the absolute necessity which exists for the construction of suitable subsiding and storeage reservoirs, so as to enable this company to impound a sufficiency of water for at least 10 days supply, and thereby obviate the necessity of taking in water during the prevalence of such heavy floods as have recently affected the river. It is, of course, optional to the company to select such a site as they may deem advisable for their intake; but I consider that the question of the removal of the intake from its present position at Seething Wells to a point above the influence of the rivers Mole and Rye would be found well worth their attention and serious consideration. At present this company have no subsiding reservoirs at all, and are therefore compelled to take the water from the Thames at Kingston, day by day, without regard to the state of the river, and they have only storeage capacity for little more than one day's supply of filtered water.

"The filtering area of this company has been nearly doubled within the last 12 months, and is sufficient for the effectual filtration of water in ordinary times; but, without reservoirs for subsidence, it is totally inadequate to contend with the occasional heavy floods which prevail, especially at this season of the year."

Acting upon this report, the samples of water were submitted by the Local Government Board to Dr. Frankland, F.R.S., for analysis, and the attention of the directors of the Chelsea Water-Works Company was drawn to the above report by a letter from the board on the 9th inst. Dr. Frankland has reported that the water he analyzed was quite unfit for dietetic purposes; a copy of his report has been sent to the Chelsea Company, with a suggestion that they should give notice to their customers that the use of household filters is necessary when the water supplied is of a turbid character; also that the company should explain to their customers the cause of such turbidity.

From the 6th to the 15th inst. the state of the river at the intake continued to be very muddy and turbid, and consequent upon the rains and floods the river rose more than 3 feet above summer level, and then gradually subsided to 1 foot 3 inches on the 8th, when it again suddenly rose to 2 feet 7 inches, and on the 16th stood at 2 feet above the summer level, during which time it was very turbid. On the 17th the water slightly improved and began to fine down. From an examination of the river book at the intake, it appears that this is the worst flood that has occurred in the Thames for the past three years. During the above period the company were compelled to distribute such water as they could get through their filter-beds, which was extremely turbid flood water, imperfectly filtered; there was a considerable amount of solid matter in the water, and it was too fine to settle, the discoloration being caused by the chalk and clay carried down by the floods. This is very difficult of removal by filtration, being only practically got rid of by subsidence previous to filtration. The company have no subsiding reservoirs of any description, and it must be borne in mind that the three new filtering-beds, lately constructed from the old reservoirs at Seething Wells, were only completed and taken into use in May last, and it is estimated that filter-beds should be in operation for at least 18 months before they will act with thorough efficiency. This period is requisite for the different filtering materials to settle to that closeness which is necessary for effectual filtration.

On the 17th a slight improvement in the water delivered by the company was apparent, and the following day and this morning (the 19th of December) it was supplied in a much better condition, being only slightly opalescent. The worst of the flood water has now passed the intake, and the company will, therefore, most probably supply clear and good water until the next flood, when the same condition of things will obtain, and continue to obtain until the contemplated works have been executed.

Yesterday (the 18th) a special meeting of the proprietors of the Chelsea company took place, and resolutions to the following effect were passed:—

That the directors be authorized to take such steps as, in their judgment, may be necessary or expedient to obtain a fresh intake with reservoirs and other works connected therewith, and lay the necessary main-pipes from the site of such proposed intake to the works at Seething Wells, with the least possible delay.

That the measures taken by the directors to secure the land necessary for the construction of impounding reservoirs be approved and adopted, and that they be empowered to appropriate temporarily such part of the company's "contingency-fund" as may be necessary for the purpose of such land, until parliamentary powers can be obtained for the proposed extensions.

That the directors be authorized to apply to Parliament in the ensuing session for the necessary powers.

The substance of these resolutions was at once communicated to the Local Government Board, and the company further stated it was their intention to lay the pipes from the site of the new intake to the existing works with the least possible delay, and also notified that a bill for the necessary parliamentary powers had been prepared and deposited.

The land, comprising an area of about 30 acres, necessary for the construction of the impounding reservoirs has been obtained within the past few days near Molesey.

The following is a *précis* of the action which has been taken with respect to the water supply and works of the Chelsea Company since the Metropolis Water Act of 1871 came into operation.

On the 16th of February, 1872, the water examiner reported that "the company evidently requires more filtering surface and reservoir capacity to enable it to avoid taking in foul water during floods; especially as the intake is below the Mole River."

On the 12th of March, 1872, the Board of Trade drew the particular attention of the directors of the company to this report.

In April, 1872, the water examiner was instructed by the Board of Trade to make a special inspection of the company's works, and to report whether the company were taking steps towards supplying the deficiency referred to in his former reports. The water examiner made a special examination in accordance with the above instructions.

He had a meeting with the company's engineer on the 24th of April. Reported as to the site of the intake, three-quarters of a mile below the river Mole. On the engine capacity (1025-horse power). How the water was pumped up to the service reservoirs on Putney Heath, 165 feet above Trinity datum, and flowed thence by gravitation to the district. On the parishes supplied. Length of pipes (varying from 3 to 30 inches), 224 miles. On the daily supply (9,620,000 maximum, 7,504,000 minimum). On the reservoir capacity, and on the construction and power of the filters.

Concluded 1st. That the filtering power required to be doubled.

2nd. That the subsiding reservoirs required to be considerably increased, and that, for all purposes of subsidence, these reservoirs were "*practically useless.*"

Referred to the application made by the company to Her Majesty's Office of Works, in January, 1872, for permission to construct a reservoir on a site in Hampton Court grounds, which was declined to be entertained. That several places for providing increased storeage had from time to time been considered by the directors, "who had experienced great difficulty in selecting land suitable for the purpose." That until further parliamentary powers were obtained, the company could not remove their intake or construct additional reservoirs for subsidence; but while these important measures were under consideration, he recommended that the existing reservoirs should be converted into filters, by which means the company would obtain a filtering area of about seven acres, nearly equal in extent to that of the West Middlesex Company, the Chelsea Company's daily supply being about 11 per cent. less than the West Middlesex supply.

The report concluded by remarking "that the question of removal of intake to a point above the influence of the Mole, and the construction of new and ample reservoirs for subsidence at the earliest possible period, should receive immediate attention; but, in the meantime, by the conversion of the three reservoirs at Seething Wells into filters, a decided improvement in the filtration would, in his opinion, be effected."

This report was forwarded to the company by the Board of Trade, and in May, 1872, the company informed the board that the following new and important works had been authorized:—

1. An addition to the present filtering area to the extent of four acres, by the conversion of the present reservoirs into filter-beds.
2. The removal of the intake from the present site at Seething Wells to a

point higher up the river, whereby the outflow of the rivers Mole and Rye will be avoided.

3. A reservoir of large capacity to enable the company, when the river is in good condition, to impound and store water sufficient for several days consumption, and thereby avoid taking water from the river when floods prevail.

The extension of the filtering area was ordered to be proceeded with at once, and application made to Parliament in the ensuing session for powers to carry out the other works.

In July, 1872, the enlargement of the filtering area was commenced. The removal of the intake, however, involved circumstances of so much importance that the directors deemed it advisable to call in an independent engineer (Mr. Bateman), whose report was laid before the proprietors in December, 1872. The cost of the works was estimated at £106,000 exclusive of the cost of the land, and also exclusive of the additional working expenses of £1250 per annum.

In January, 1873, the bill to authorize the new works of intake and reservoirs was submitted to, and approved by, the proprietors of the company.

In February, 1873, the company informed the Local Government Board (*inter alia*) that the supply being then taken from the Thames below the point where the rivers Mole and Rye at times discharge turbid water into the Thames, entered into the scope and object of the bill, and requested the president of the board to grant an interview to a deputation of the directors.

The president received the deputation, and was informed that the scheme contemplated by the bill was for improving, at great cost to the company, the quality of the water supplied by them, and that there was considerable opposition to the bill in consequence of the site selected for the reservoir being on the opposite side of the Thames to Hampton Court grounds, and also that the erection of a river wall was contemplated, which was supposed by the opposition to be unsightly and objectionable.

The deputation stated that the bill was promoted by the company in order to comply with the views of the water examiner, acting under the Local Government Board, who objected to the company's present intake (which is below the rivers Mole and Rye), and also considered the company ought to have a large extent of reservoirs for storeage and subsidence.

The deputation also submitted their answers to the statements made by the opponents of the bill, as well as the following report from Mr. Bateman:—

"In the construction of the works there is no occasion to disturb a tree on the bank of the river, and the sylvan shade, which is now so much prized, may be preserved in its integrity. The flat meadows behind the belt of riverside trees, on which the reservoirs are proposed to be made, cannot be seen from any residence, except partially from the western portion of Hampton Court Palace, and the part which can be so seen is, at present, utterly devoid of beauty.

"In the formation of the embankment, an undulating outline, to please the eye, may be adopted, and, as the dull monotony of the flat land at Battersea Park, and in some parts of Regent's Park and Hyde Park, has been relieved by raised mounds, ornamentally planted, so may this ground be greatly improved in beauty, and, by a judicious mixture of evergreen and deciduous trees, may be rendered, in a few years, one of the most pleasing and picturesque parts on the banks of the Thames."

On February 27, 1873, the bill was lost on second reading in the House of Lords, and on June 26, 1873, the directors reported the loss of the bill at the ordinary meeting of the company, and it then became a question with the company whether, as the opposition had been directed against the construction of the proposed reservoirs, it was desirable to proceed with another bill in that session for the pipe-line only; but it was considered that, inasmuch as the first bill had been introduced into the House of Lords, there would probably be a difficulty in obtaining the sanction of Parliament to the introduction of a second bill with diminished powers, which bill would have to be introduced into the House of Commons, and it was finally determined to be inexpedient to promote another bill in that session.

(At this meeting the directors were authorized to lay an additional pumping-main from Kingston to Putney, and this work was completed by the end of May, 1874.)

On the recommendation of the water examiner, the company also authorized the covering in of the high-service reservoir for filtered water at Putney, hitherto uncovered and not in use, by which their storeage of filtered water was increased by 1 million gallons. This work was completed and the reservoir taken into use in June, 1874.

From June, 1873, no steps appear to have been taken by the company to provide for the removal of the intake and the construction of impounding reservoirs, the necessity for which was admitted. The water examiner, however, continued regularly to call attention to the desirability of these works, and in his report of the 31st of January, 1874, to the Local Government Board on the various duties performed by him under the Metropolis Water Act during the years 1872-73 (which report is published in the third annual report of the board), he states:

"Within the past three years the water companies have, of their own accord, and in consequence of the recommendations of the Board of Trade and Local Government Board, incurred and undertaken an expenditure of £654,504 to extend the storeage capacity of their reservoirs and increase the area of their filters, as well as to provide for the requirements of constant supply by the construction of high-service reservoirs for filtered water, as well as by the addition of powerful machinery to their works, and these measures have, without doubt, materially improved the water supply of the metropolis; yet much remains still to be done—notably, the extension of the constant supply by all the companies, and the construction of additional subsiding and impounding reservoirs by the Chelsea, Grand Junction, and Southwark and Vauxhall Companies, also the removal of the Chelsea intake to a point above the outflow of the river Mole at Hampton Court Bridge, the necessity of all of which I have continually called attention to in my usual monthly reports."

After its publication, a copy of this report was sent to all the metropolitan water companies, and in November a letter was written by the Local Government Board to the Chelsea Company calling their attention thereto, and asking the directors what action, if any, they intended taking. To this a reply was sent, that they were taking steps to acquire the land necessary for the reservoirs, and that the subject would shortly receive the special consideration of the company.

A notice was issued on the 1st of December, calling an extraordinary meeting of the governor and company of the Chelsea Water-Works on the 15th day of December inst., to receive (*inter alia*) a report from the directors on the question of removal of the intake from Kingston to a site above the river Mole, and the erection of works connected therewith, and to pass such resolutions as by the meeting shall be deemed expedient.

The result of this meeting was the passing of the several resolutions above mentioned, by which the carrying out of the works recommended by the Local Government Board, on the reports of the water examiner under the Metropolis Water Act, 1871, were duly authorized by the company to be executed with the least possible delay.

FRANK BOLTON, Water Examiner.

The Secretary to the Local Government Board, Whitehall, S.W.

PRICE OF GAS AT KEIGHLEY.—At the meeting of the Keighley Local Board on the 22nd inst., a proposal was made to reduce the price of gas after the 1st of January next to 3s. per 1000 feet; but that, as well as one to make the scale of discounts uniform—namely, 5½ per cent.—was lost by a large majority.

EXETER GAS-WORKS.

PROFESSOR REDWOOD ON THE ALLEGED NUISANCE.

At the Meeting of the Exeter Town Council, on Wednesday, Nov. 25—the MAYOR (H. C. Lloyd Esq.) presiding,

The TOWN-CLERK read a report prepared by Dr. Redwood, Professor of Chemistry, of London, who had been employed by the council to inspect the works of the gas company, at the Basin. The professor stated that having obtained certain data as to the nuisance complained of in the city, he, on the 24th of October, proceeded to the gas-works, accompanied by the surveyor, Mr. Dand, the manager of the works, conducted them through. No disposition was shown to suppress any information as to the mode of manufacture. The retorts were opened and discharged, and one of the purifiers was emptied, and certainly during their stay there was nothing that could have been a source of annoyance to any one outside the works. In continuation, Dr. Redwood says:—

I particularly inquired of the manager as to how the ammoniacal liquor was got rid of, and was informed that it was sent in covered trucks formerly to Bristol, but latterly to Plymouth, and that it was conveyed through an underground pipe to a siding of the railway, where there was a stand-pipe, from which it was run into the trucks. This, if carried fully into effect, appears to be a very unobjectionable method of removing and getting rid of the liquor, the most offensive product of gas manufacture, and the disposal of which is often the gas-maker's greatest difficulty.

Having some doubt whether a product of so little commercial value as gas liquor could be sent so great a distance by rail without entailing expense on the gas company, I inquired whether any method was resorted to for getting rid of it on the premises or in the neighbourhood, and was told that formerly there were ammonia works in the neighbourhood that took it, but that they had been suppressed, and that no use was made of it on the premises. I was not then aware of some of the observations bearing upon the subject that appear to have been made by neighbouring residents, and which have been since communicated to me, or I would have pressed this inquiry further with the manager. It was perfectly evident, however, that the process of ga-smaking and purification, every necessary part of which was in full operation while I was on the premises, was conducted, and might be always similarly conducted, with the appliances and arrangements, provided there in a perfectly inoffensive manner, and, in fact, without causing any smell that could be perceived on the other side of the river. In saying this, however, I allude only to such emanations as proceeded from the body of the works, and which might affect the outside atmosphere at the same, or about the same level. Anything escaping from the tall chimney—which, by-the-by, might, I think, be raised with advantage—would not be perceived within or in the immediate neighbourhood of the works, but might nevertheless affect the houses on the high ground opposite.

After leaving the gas-works, the inspection of which had certainly not led to the discovery of any sufficient cause for the bad smells complained of, the evidence was laid before me of persons who had observed phenomena connected with these works, which seemed to show that their condition at the time of my visit was not that which always prevailed there. A communication from a lady living opposite, and within sight of the gas-works, was put into my hands, in which she says: "I fully endorse the remarks made in last Monday's *Telegram* as to the horrible smell (to use no stronger term) to which we were exposed on Sunday morning last, from about half-past ten to eleven o'clock, and simultaneously with, or almost instantly after it was perceptible, a thick volume of foul yellow smoke was to be seen pouring from a part of the gas company's buildings near the Basin, while from two of their chimneys also dense smoke was proceeding. The gas company, I understand, profess not to work on Sundays, yet at about half-past twelve the same day their premises were enveloped in blue smoke rising from the buildings themselves, and Sunday after Sunday has this been the case, accompanied by the offensive odour of which we so much complain. For many months past I have both night and day, at intervals, watched the gas-works when this disgusting smell was perceptible, and invariably smoke was to be seen proceeding from between parts of the building or immediately behind it, between it and the gasometer. At twelve o'clock at night, at one, two, and three in the morning the smell has often been so insufferable as to awaken me, and on looking towards the works this has been the case, the whole place being in clouds of smoke."

Other observers, who have experienced the smells, and have at the same time been within view of the gas-works, have described to me the appearance presented by the smoke they have seen issuing from the chimney of the retort-house while the offensive smell prevailed. One gentleman said it looked like steam when it escaped from the chimney-top, but as it passed through the air it darkened in colour, and assumed ultimately the appearance of ordinary smoke, which seems to indicate that a mixture of steam and smoke first issued, but in passing through the air the former dissolved and disappeared as the steam does that escapes from a locomotive, while the smoke that was previously concealed by the steam remained and became apparent.

Now some of these facts appear to me to have an important bearing upon the case. In gas manufacture, fairly and legitimately conducted, in the way it was being conducted when I visited the Exeter Gas-Works, and as the process was described to me by Mr. Dand, the manager, there should be no smoke from the chimney of the retort-house, because the furnace fires by which the retorts are heated are fed with coke, but even if there should be a little smoke, there certainly should be no steam, and the appearance of mixed steam and smoke issuing from the tall chimney is suggestive of something unusual and not legitimately connected with the process of gas-making, as described by the manager. And when, in addition to these phenomena being observed, it is found that they occur simultaneously with the occurrence of the offensive smell, it is impossible to resist the suspicion that they are in some way connected, and probably both arise from the same cause.

I have been asked to explain how I could account for the phenomena I have referred to, and I therefore beg to offer the following suggestive remarks:—When gas is produced by decomposing coals in retorts heated with coke fires, and the resulting gas is purified by first washing it in scrubbers, and then passing it through oxide of iron and lime for its final purification, as is done at the Exeter Gas-Works, the tar and gas liquor being at the same time collected and confined in close tanks, the whole process may be conducted without any offensive odour escaping, and if care be exercised, the only indication in the immediate neighbourhood of such a manufacture being carried on is caused by the escape of a little smoke and gas when the retorts are being charged and the contents of the purifiers are changed. But the tar and ammoniacal liquor which are necessary, and bulky products of the process, are inoffensive only as long as they are kept in close vessels, or are used with every precaution against the escape of some of the very noxious vapours they are capable of emitting. This refers especially to the ammoniacal liquor, and only to the tar to the extent to which it retains some of the gas liquor attached to it. In some places both these products of the manufacture of gas have a commercial value, and especially the tar, but even this at some gas-works is used as fuel by burning it in the retort furnaces. The gas maker's great trouble, however, is the ammoniacal liquor, which soon accumulates on his hands, unless he has ready means for disposing of it. If there are ammonia works near at hand this may be done, but, under the most favourable circumstances, it is of very little value, and if it has to be sent any considerable distance to find a market for it, the cost of carriage exceeds the price it can realise. Gas makers often pay to have it taken away, and they must necessarily do so if it has to be taken any distance by rail. To save this expense various expedients are resorted to by which the gas liquor can be got rid of. At some small works I have known it to be used instead of water for extinguishing the coke when this is drawn out of the retorts, and in many

instances it is run into the ash-pits of the furnaces by which the retorts are heated. Sometimes iron pans are fixed under the furnace bars and the liquid run into them and allowed to pass in vapour through the fire and the hot flues surrounding the retorts, where it is wholly or partially decomposed. The first of these methods could only be practised where there are only small quantities of the liquor to be got rid of, and even then so objectionable a practice would hardly be carried into effect, except in the middle of the night. The other methods afford means for disposing of large quantities of the noxious liquid, for the process may be in constant operation, and while the fires are strong and the flues red hot, the ammonia and sulphur compounds, and even the water, would be decomposed and resolved into gases, some of which would be combustible, and all of them much less noxious and offensive than the abominable products which the simple evaporation of the liquid would yield.

The usual construction of gas retort furnaces, with the fronts wholly enclosed, facilitates the application of this process without its being observed by those passing through the retort-house. Under the most favourable conditions of its application, that is, while the fires are all strong and the flues hot, it may accomplish the intended object without producing any serious nuisance, the worst effect being the emission of an increased quantity of sulphurous acid gas from the chimney; but if the fires should be slackened, so that the heat in the furnaces is insufficient to decompose the liquid and all its foul contents, there may still be heat enough to convert these into vapour, which would be sent forth from the chimney, partly as steam and partly as a nuisance—gas that would possess the character of that complained of by the inhabitants of Exeter.

If at any gas-works, where the process alluded to is adopted, the manufacture should be wholly or partially suspended on one or two days of the week, there would especially be times when foul smells, caused in the way I have indicated, would be likely to be experienced, unless very particular precautions were adopted to prevent any portion of the ammoniacal liquid remaining in the furnaces when the fires were allowed to slacken, or when they were again kindled.

I have no direct evidence to show that the smells which are complained of in Exeter, and which I have been called upon to assist in tracing to their source, are produced in the way I have indicated, but circumstances that have been communicated to me since I had an opportunity of inspecting the gas-works, appear to justify a suspicion that there may be some occult arrangement for getting rid of ammoniacal liquor that was not explained or made manifest to me, which either necessarily, or from carelessness on the part of workmen, may occasion the evil complained of.

I have no doubt that the gas company will be willing and anxious to relieve themselves from any suspicion on this point, by showing that they have no means of sending any of their ammoniacal liquor into the furnaces, and practically that they send away from the works all that they produce.

Alderman FOLLETT was sure all who had listened to the report would agree with him that it contained important information—information, perhaps not of a very decisive, but of a very suggestive, character. It was not for him for one moment to say whether the suggestions drawn out by Dr. Redwood pointed at practices of the gas company, but he had no doubt the report, when sent to them, would receive the very careful attention of the directors and manager. They were aware that he (the speaker) took a great deal of pains with regard to that matter during the last two or three months he was in office as mayor. During that time he received a great deal of information from a number of the citizens, and the result of that information tended to this, that although the evil was not thoroughly cured, it had been considerably abated. He had ascertained that from persons who made very accurate observations in the matter, therefore the manufactory from which that smell proceeded must have made some alteration that tended to its abatement. They knew that very material alterations had been made in the gas-works, and that gave them some reason to suppose it had something to do in improving matters. He was very much pleased the other evening when a gentleman residing in the neighbourhood, and who had been at great pains to trace the source of the evil, came to him and stated that it had been entirely removed. He suggested to the mayor that he should continue to elicit information from the citizens of Exeter on the matter in the same private manner as he (the ex-Mayor) had done, so that he might obtain all desirable evidence respecting the nuisance.

The MAYOR said he would adopt Alderman Follett's suggestion, and would like the public to understand that the energies of the council in endeavouring to abate the nuisance would in no way be slackened. He believed the public would assist him in the matter by communicating to him all the information they knew respecting it.

It was agreed to send Dr. Redwood's report to the gas company, and the matter then dropped.

The report of Dr. Redwood having been communicated to the gas company, the following letter thereon has been written by their secretary to the town-clerk:—

"*Exeter Gaslight and Coke Company, Exeter, Dec.* 16, 1874.

"Dear Sir,—I am desired by my directors to acknowledge Dr. Redwood's report of his inspection of the gas-works, and to thank you for the same. The report of such inspection, so far as the directors can see, fully confirms that previously given to the directors of the gas company by Dr. Letheby.

"As to the suggestive remarks of Dr. Redwood, relative to the ammoniacal liquor, the directors regret that Dr. Redwood, on receiving the information supplied to him, should not have thought it necessary, on so important an inquiry, to have fully investigated the subject previous to his making his report, and he would then have been convinced the company have no means of sending a stream of steam through either of the chimneys of the retort-houses, or any apparatus for sending the gas liquor into either retort-house.

"The directors beg to state positively that in no instance has any ammoniacal liquor been used in any way on the works, and further that they are under a contract to send off by rail the whole of the ammoniacal liquor they make.

"The directors beg to add that Dr. Redwood visited the works without any intimation to the company of his intention to do so, and the operations he then saw and approved of were the usual daily operations of the company.—I am, dear sir, yours faithfully, "WM. A. PADFIELD, Secretary.

"B. C. Gidley, Esq., Town-Clerk, Exeter."

This letter was laid before the Town Council at their meeting on the 23rd inst., and it was resolved to send a copy of it to Dr. Redwood.

WORCESTER GAS SUPPLY.

The Directors of the Worcester Gas Company have forwarded to the Town-Clerk the following reply to the report of Messrs. Carter and Carter, upon the accounts filed by the company with the Clerk of the Peace, which report was published in the JOURNAL of the 15th inst.:—

"*New Gaslight Company's Offices, Worcester,*
"*Dec.* 17, 1874.

"Dear Sir,—My directors have had under their consideration the report of Messrs. Carter and Carter on the accounts filed by this company with the clerk of the peace from 1862 to 1873, a copy of which report you sent me with an intimation that the Watch and Lighting Committee would be glad to consider any observations my directors might make thereon.

"Messrs. Carter and Carter's report appears to be based on an opinion entertained by them that this company have no power to enlarge or extend their works out of revenue, but that, having expended the whole of the capital authorized to be raised by the company's Acts, the directors were bound, if they required to enlarge their works, to apply to Parliament for power to raise additional capital, and so, from time to time, as often as the requirements of the district necessitated an additional outlay. My directors, however, submit that, having regard to the company's Acts, and the Acts incorporated therewith, combined with the general objects and purpose for which the company was established, they have power to devote any part of the profits of any year to enlarging the works for the purpose of properly supplying with gas the inhabitants within the limits prescribed by the Act. The 33rd section of the company's Act, 1846, enacts that it shall be lawful for the company, subject to the restrictions therein contained, from time to time, to make, construct, lay down, maintain, alter, or discontinue such retorts, gasometers, receivers, drains, sewers, machinery, and other works and apparatus, and also such houses and buildings, and approaches thereto, upon the lands thereby authorized to be purchased by the company, and to do all such other Acts as they shall think proper, consistently with the provisions of that Act, for supplying the inhabitants within the limits of the Act with gas, and for other purposes authorized by the Act. The 23rd section of the same Act provides that, in order to ascertain the profits, the company shall cause an account to be annually made of all the moneys received, and of all costs, charges, and expenses of and attending the purchase, construction, repairing, and maintaining of the works thereby authorized, and of carrying on the undertaking, and if the clear profits after payment of all such costs, charges, and expenses, shall in any year exceed 2 per cent. upon the share capital, the excess beyond the sum which may be necessary for the purposes aforesaid shall be invested to form a contingent-fund. Unless, therefore, it can be contended (which my directors do not understand Messrs. Carter and Carter to do) that the company are not authorized from time to time to enlarge or extend their works, there would appear to be no doubt that the directors have properly applied the income of the company for these purposes.

"My directors would also beg to refer you to the 'Companies Clauses Consolidation Act, 1845', (which is incorporated with the Worcester New Gaslight Act, 1846), the 122nd section of which provides that before apportioning the profits to be divided among the shareholders, the directors may set aside thereout such sum as they may think proper for enlarging, repairing, or improving the works connected with the undertaking.

"As regards the deduction for wear and tear, which Messrs. Carter and Carter say is not an expense, my directors would ask whether, in estimating the expense of any commercial undertaking, it would be safe not to take into consideration the annual depreciation from wear and tear, or to consider that ordinary repairs would put plant and works in as good a state as when first erected.

"My directors differ from Messrs. Carter and Carter in their opinion as to the power of this or any other company to borrow money for temporary purposes. My directors believe such to be the general practice of companies, and they save more by obtaining discount than they pay for interest.

"As to the question of income-tax, before the year 1863 the company were never in a position to pay the full amount of 10 per cent. dividend on the share capital, but in that year some of the shareholders considering they were entitled to the full amount of 10 per cent. without any deduction for income-tax, the directors took the opinion of counsel, who advised that the income-tax was a part of the costs of carrying on the undertaking, and that the dividends should be paid up to 10 per cent. The shareholders have accordingly since that time been paid their dividends without any deduction for income-tax, and it is believed that other companies under similar restrictions do the same.

"Under the company's Act, 1846, section 84, the company were required to purchase the houses, land, plant, and works of the then Worcester Gaslight and Coke Company, and by section 30 of the same Act the company were empowered to purchase not exceeding five acres of land in addition. Under the powers in this Act the directors have from time to time, as they found it necessary for the extension of the company's works, purchased houses and land, but I need hardly say that in no case have the directors ever done so except for the purposes of the company; in fact, there is no one property which the directors have purchased, the whole or part of which has not been used for enlarging the company's works.

"With reference to the balance-sheet, my directors would remark that for the years 1865 and 1866 the balance-sheet of the company was prepared in a different form to that now adopted, and that the receipts and expenditure were under headings, 'Capital, liabilities, &c.,' and 'Assets and expenditure,' and that while on the other side of the account the total amount reserved or expended for extensions and renewals since the formation of the company was entered under the head of 'Capital, liabilities, &c.;' on the other side the total amount actually paid was entered under the head of 'Assets and expenditure.' In 1867 it was thought that it would simplify the accounts to prepare a balance-sheet under the headings of 'Liabilities' and 'Assets,' and to omit from the balance-sheet on one side the amount reserved, and on the other side the amount paid for extensions and renewals—not, as Messrs. Carter and Carter seem to think, for one year only, but from the formation of the company, and this will account for the difference, as pointed out by Messrs. Carter and Carter, between the balance-sheet for 1865 and 1866 and that for 1867. I may add that the balance-sheets were prepared by a public accountant, and not by any officer of this company.

"The amounts entered in the balance-sheets up to 1866 as reserved were not, as Messrs. Carter and Carter treat them, for a contingent-fund, but for extensions of works, new mains, &c., as will be seen on reference to the balance-sheets, and the greater part of the money was actually expended during the current year for which the balance-sheet was prepared.

"For the above reasons my directors confidently submit that the gas consumers have not, as stated by Messrs. Carter and Carter, paid anything which the company should have raised by additional capital.—I remain, dear sir, yours faithfully, FRED. N. GOSLING, Secretary.

"*Guildhall.*"

ON THE CAUSE OF THE LIGHT OF FLAMES.

By W. STEIN.

The correctness of the old and well-founded conception that the light of flame is caused by incandescent carbon molecules has been disputed by Dr. Frankland, who contends and tries to prove that it is derived from hydrocarbon vapours. It is evident that the old theory would have to give place to the new doctrine as soon as the untenability of the former and the correctness of the latter are proved. But neither the one nor the other has, I think, yet been done. Professor Frankland can, therefore, only be pleased if the present paper subjects the *pros* and *contras* of the new and old theory to an impartial examination.

I must mention that I have not been able to read the original paper of Dr. Frankland and have only had the opportunity of consulting "Dingler's Journal," the "Chemical Centralblatt," the "Annual Report of Chemistry," and the "Ann. Chim. Phys." According to these, Frankland considers that the light of the flame is derived from very dense hydrocarbon vapours, of which he particularly mentions benzine and naphthaline.

As proof of his ideas he mentions—1. That the soot deposited on a cool surface, when introduced into a flame, does not consist of pure carbon, but that it contains also hydrogen; that, in fact, it seems nothing else than a collection of the densest light-giving hydrocarbons, whose vapours condense on the cold surface.

Against this we may mention that not only do the heavy hydrocarbons, but even marsh gas, split up at high temperatures on exclusion of atmospheric air; and as the hydrocarbons, whose vapours are supposed to cause the luminosity of the flame, are precisely under such conditions before they come in contact with the air, it cannot be doubted that they suffer decomposition into carbon and hydrogen in the luminous portion of the flame. It is of little

importance whether the eliminated carbon is chemically pure, or whether it contains still a hydrogen compound; the important question is this, Is the soot held by the flame in the shape of vapour or in the solid form? If the soot was nothing but a conglomeration of the densest light-giving hydrocarbons, whose vapours condense on a cool body, then, when sufficiently highly heated by exclusion of air, it ought to reassume vapour form. This is, however, not the case, as every one will find who tries the experiment.

Its chemical composition is just as little favourable to Frankland's view. It ought, presumedly, to vary according to the lighting material from which it was derived—nay, even according to the place of the flame wherefrom it was deposited. It is well known that the temperature of the flame varies in various places, and Magnus's experiments have proved that from heavy hydrocarbons at a less high temperature a hydrogenous tarry product besides hydrocarbon is also eliminated. The soot whose analysis I give was obtained from a bat's-wing burner by allowing a small silver basin, filled with water, to dip for about two or three minutes into the flame. Benzine removed traces of a solid yellow body, but the small amount of it prevented it being further investigated. Alcohol, and alcoholic solution of caustic potash, and dilute sulphuric acid dissolved nothing.

After being carefully and repeatedly washed with boiling water and dried at 130°, 0·206 yielded: Carbonic acid, 0·6985; water, 0·0195; ash, 0·0020; which amounts in 100 parts to—

	Containing Ash.	Free from Ash.
Carbon	96·446	97·390
Hydrogen	1·051	1·061
Ash	0·970	—
Oxygen	1·533	1·549

I attribute the presence of oxygen to a small amount of water which, even at 130°, was still retained, and this, when deducted, gives the composition of 100 parts of soot free from water and ash as consisting of

Carbon	99·095
Hydrogen	0·905

This analysis is in accordance with the chemical composition of the soot of the flame, and with the well-known behaviour of heated hydrocarbons.

2. "How could the light of a flame be as transparent as in reality it is, if it was filled with solid carbon particles?" asks Dr. Frankland.

In reply to this, it must be admitted that one is able to read the writing held behind the flame of a bat's-wing burner. It is, however, easily observable that the flame is more transparent in the lower, non-luminous portion. The reading becomes also more difficult through a flame of greater thickness, and impossible through the flame of a candle or petroleum burner. If, as is proved hereby, the transparency of a flame is only very limited, it may be remembered that one can also read the same writing through media which are known to be filled with solid particles; for example, through a piece of opal glass, or oiled paper, or linen. The partial transparence of the flame cannot, therefore, serve as proof of the absence of carbon molecules.

3. To understand the further query of Frankland, "How could it be indifferent for photometrical measurement, whether the flame presents the flat or narrow side, if the light is given by solid carbon molecules?" we have to recollect an observation of Arago. At Paris they wanted to know what position the flame of the street-lamps had to be in to produce the best light for the *trottoirs* as well as for the carriage road. Arago made experiments, and found that the narrow side of the flame radiated as much light as the broad or flat side. This result caused general surprise, because it was assumed that light was only given off from the surface of a flame, the surface layers of carbon particles absorbing or retaining the light of the interior layers. It may, however, easily be understood that such a view arises only from a misapprehension of the process. A body can only lessen or stop the light which falls upon it from another body, if it is either only very little or not at all luminous. If both bodies possess equal luminous power, the result will be double in effect. Two carbon molecules placed one behind the other, and both radiating the same amount of light, cannot possibly weaken each other; their radiations, on the contrary, must be considered as two waves of equal amplitude and velocity, travelling either one immediately after the other, or collapsing in such a way as to double the height and depth. The luminous power of a flame must therefore be just as large on the narrow as on the flat side, because in both positions the number of the light-radiating carbon molecules is equal. The light appears, however, to the eye to be denser on the narrow side, because it is produced by a greater number of molecules vibrating, and after or behind one another.

4. To demonstrate that his view of the luminosity of vapours is not without example, Frankland refers lastly "to the development of light which is produced by the burning of arsenic, phosphorus, and bisulphide of carbon in oxygen, at ordinary pressure, and by the burning of hydrogen and carbonic oxide at higher pressures, in which cases the assistance of solid particles cannot be presumed."

Scientifically valuable and interesting as all this is, so little does it demonstrate that the process of our luminous flame is an analogous one, the remaining fact that solid bodies are by preference apt to become light-radiating is not at all changed by this, and up to now it is only demonstrated that it can be one solid body to which the luminosity of flame can be attributed. If we consider therefore, all the before mentioned, we can only draw one conclusion—namely, "That the light of our illuminating flame comes from incandescent carbon molecules, and that the old view is still to be retained."

Experience teaches that for the artificial production of light, a high temperature is requisite before all things. Temperature is, however, that part of the total heat of a body which influences the surrounding parts, or the surplus of atomic movement which is not consumed by its inner work. A high temperature means, therefore, a great excess of such movement, which again is identical with a greater number of momentary vibrations. In fact, the movement of light and the movement of heat differ essentially by regularity (*Rhythmen*) and greater velocity. The movement of heat passes, therefore, presumedly into movement of light, if it has reached the lowest number of vibrations for light—namely, those of red light. If, after a greater and greater rising of temperature up to its highest possible degree, the rapidity of movement increases more and more, we observe, besides the red light, first, yellow light, forming orange with the former; later, we meet also blue light, which, however, in most cases, only serves to form white light with the red and yellow, and which is only predominant in very rare cases, as observed by Deville. Under ordinary circumstances, we only get a yellow or red light containing more or less white. The more white it contains the greater is, naturally, its effect of light; and, as white only appears at the highest temperatures, it becomes evident that the temperature of a flame does not exert a secondary influence on its luminosity, but is its principal factor. The second factor is the eliminated carbon, the molecules of which radiate the light. The luminosity of two flames of the same temperature corresponds, therefore, to the number of its carbon molecules, and "luminosity in general equal to the product of the radiating molecules and their temperatures" for luminating purposes, it may be presumed that the latter should amount to at least 1000°.

The above-mentioned phenomena of light may easily be observed on solid bodies if heated. They are not observable on gases as long as they expand unhindered. It would, however, be wrong to attribute this negative behaviour to the circumstance alone that, by the unhindered expansion, the amount of the added, or produced, heat was changed into power. This is contradicted by the high temperature which, amongst others, the non-luminous explosive gas-flame (*Knall gas*) possesses.

Besides, it is also observed that platina wire becomes incandescent in every possible non-luminous flame, even in a flame produced by nitrogen on coal gas, if the requisite temperature to change heat into light is present.

If we may conclude from this that the atoms of gases may be brought into light vibrations without becoming luminous, then we possess bodies which conduct the light (the gases), and others which radiate the light (the solid bodies), analogous, as we have conductors of electricity and idioelectrical bodies.

An explanation of this difference is offered when light is considered as atomistic movement. Its effect to the eye is then the product of quantity and velocity.

In a given space we find a much larger number of vibrating atoms if filled with solid matter than if filled with a gas. The waves of light of solid bodies must, therefore, be much denser than those of gases, and exert also a more intense effect on the nerves of our eyes. "Light-conductors" differ, therefore, from "light-radiators" by the lesser density of their waves of light; for which reason they cannot, under ordinary circumstances, form "optical molecules," as I expressed it at another occasion. How powerful the condensation of the waves of light affects the eye is shown by the effect of collecting lenses.

The minimum of density which a body must possess to become light-radiating—that is, to become self-luminating to the eye, or to appear a source of light—is just now not known; but one sees, if this view is correct, the possibility of even vapours or dense gases becoming luminous, as Frankland tried to prove. The results of his experiments might even serve as foundation for the lowest limit of density, if it were not so very difficult, nay, even just now impossible, to make such experiment in a manner as to exclude every doubt about the assisting influence of solid bodies.—*Journal für Gasbeleuchtung, Nov.* 9, 1874.

POLLUTION OF STREAMS IN THE POTTERIES.

At the Monthly Meeting of the Town Council of Stoke-upon-Trent, held on the 17th inst.—the MAYOR (Alderman Dickinson) presiding—

Mr. KIRKHAM, in pursuance of a motion of which he had given notice, addressed the council on the question of the pollution of the streams of the town. He had made an examination of the various sources of pollution, and he had also considered the best means of remedying the same. The first stream he inspected was the Lyme Brook, which he found to be actually worse than the Foulhay Brook, bad as they knew the latter to be. He also visited the Newcastle tanks, and he certainly had not the slightest idea of the serious state they were in. They were neither more nor less than a series of cesspools into which the sewage emptied itself. The stench was simply atrocious, even at this time of the year, and what must it have been in the warmer months? It was within a few yards of the highway, and not far from the union workhouse, where he had been told the fever was almost chronic. A person said to him, when he remarked upon the nuisance, "Ah, but you should have been here a few months ago." He ascertained that there was a culvert emptying into the brook near the gas-works, another drain higher up, while the sewage from Knutton and Apedale was also discharged into it. Then it received the sewage from the large district of Silverdale, which was no little matter. Examining the Trent, he found that numerous sewers from Hanley poured into it. One, he had been informed, was an outfall for a portion of their new sewage works. He also found that the Foulhay Brook was polluted by numerous sewers and open drains from Hanley, Burslem, Wolstanton, and other places. There were other smaller pollutions in great abundance, but those he had alluded to were the chief contributors to that mass of sewage which was daily flowing down upon them at Stoke. He considered it was high time they took some action, especially as regards the Newcastle tanks, which were within the borough of Stoke. The only cure for them was their entire removal, and he should recommend the council to take steps to get them removed. He also recommended the erection of three 6-feet flood-gates, so that they could be lifted up at flood time, and the bed of the river would then be completely scavenged, instead of the sewage water backing into the cellars, as was now the case. The lessee of the mills was not indisposed to have flood-gates placed there. Another matter to which he wished to direct the attention of the council was a report that the Hanley people were going to deodorize their sewage in a field near Winton Terrace, and pour the water into the Trent near there. The Stoke Council ought to take every step to prevent the Hanley people from carrying out this scheme. The conclusion he arrived at was, that so far the neighbouring authorities had not done their duty to prevent this state of things. One gentleman said to him the other day, half in joke and half in earnest, "Nature formed Stoke into a natural cesspool for the Potteries, and if people choose to build there, they must take the consequences." He hoped that some means would be adopted to promote a scheme in which all the Pottery towns could join, but if they would not join, he for one was quite prepared to advise that council to restrain the other towns from polluting the streams by an injunction. The death-rate of Hanley was 18 per 1000, while that of Stoke was 25, and it behoved them, as representatives of the people, to see if something could not be done. He begged to propose that proceedings be taken against the Newcastle authorities in the matter of the tanks, that flood-gates, which could be lifted, should be erected at Boothen Mills, and that a permanent committee should be formed to deal with the whole question.

Mr. KEARY, in seconding the motion, said the council was very much indebted to Mr. Kirkham for making the examination, and bringing its results before them in such a lucid manner. If there was only one body, there would not be so much difficulty; but here they had five different local authorities, besides two or three places like Knutton, which had no local authority, and an infinity of individual trespassers. It was exceedingly difficult to know how to deal with the question. The facts brought forward, however, gave them ground for taking proceedings in the matter of the Newcastle tanks, which had been a grievance for years. On one occasion the authorities of Newcastle had been summoned before the magistrates, but that was only a temporary remedy. He believed, however, that now the Newcastle people had called in an engineer, and no doubt he would recommend some plan which would be effective in dealing with the sewage of that town. The Stoke Council could not do wrong in insisting upon the alteration of the tanks, because proper notice had been more than once given. With regard to Hanley, they might report to the Local Government Board that that town had not complied with the conditions upon which its drainage loan had been borrowed—viz., that the sewage should not pollute any stream. He also thought they ought to do all they could to prevent the deodorization of the Hanley sewage close to their boundaries. He deprecated the expense of an injunction, and reminded his hearers that the Duke of Sutherland's suit against Tunstall, which had been pending at great expense for two years, was still unconcluded. He highly approved of the appointment of a permanent committee to deal with the subject, and hoped that some scheme, in which all the districts could join, would shortly be brought forward.

Alderman SWEETING suggested that the lessee of the millpool at Boothen be requested to clean it out, and that the rector be asked to put up flood-gates. He bitterly complained of the sufferings experienced by the inhabitants of the "Bristol Channel" in the late flood.

Mr. KIRKHAM replied that it would be unfair to call upon the lessee to clean out the filth, when other people were responsible for sending it down to his pool; and as to the rector, he had long ago refused to have anything to do with putting up flood-gates or interfering with the lessee.

The motion was then carried, with the *addendum* that the authorities of Fenton be invited to co-operate in the matter of flood-gates.

A SECRET OF THE SEDGLEY BREWING TRADE.—At a meeting of the Upper Sedgley Local Board, on Tuesday Dec. 22, Dr. Eagleton condemned the water supplied by the water-works company as being full of organic filth, but added that it was capital water for brewing purposes, and that brewers were making good use of it, as they did not use so much malt owing to the substantial qualities of the water.—*Birmingham Daily Mail.*

POLLUTION OF THE RIVER LEA.—At the meeting of the Tottenham Local Board on the 22nd inst., the clerk stated that he had been served with a formal notice by the Lea Conservancy Board requiring the board within thirteen calendar months to discontinue the flow of any sewage or other offensive matter through any sewers, drains, pipes, channels, or open ditches which run into and communicate with the Moselle and discharge into the new dock or cut at the sewage works.

IBSTOCK GAS COMPANY.—On the 10th inst., a meeting was held at Ibstock to take into consideration the lighting of the town, and in the result it was resolved to form a gas company, with a capital of £4000, composed of 4000 shares of £1 each, the shares being made thus low to enable every inhabitant of Ibstock to take them of which privilege nearly all present availed themselves; 1000 shares were taken up at once. The success of the undertaking is not in the least doubted, as the population of Ibstock is 2000, and in a few years there is a prospect of doubling its present number of inhabitants.

A FROZEN WATER-MAIN AT SHEFFIELD.—During the severe weather on Sunday, the 20th inst., a 14-inch main, supplying the higher parts of the town of Sheffield, was frozen up, and great inconvenience from the stoppage of their ordinary water supply was thus occasioned to the inhabitants of these districts. The company promptly met the emergency by causing large fires to be lighted on the ground over and about the spot where the obstruction was supposed to be, and their officials made every effort to further the work, but it was not until Monday night that their labours were crowned with success.

EFFECT OF DAMP AIR ON COAL.—Mr. Varrenstrapp finds, by recently conducted experiments on this subject, that the loss in weight, due to a slow oxidation and to the disengagement of gases which form the richest part of the coal, may equal one-third of the original weight. The heating power in such coal was lowered to 47 per cent. of its former capacity. The same coal exposed to the air, but in a closed receptacle, did not lose more than 25 per cent. of gas and 10 per cent. of heating power. Bituminous coals alter most rapidly. This shows the disadvantage of damp cellars, and of leaving coal uncovered for long periods and subject to bad weather. Judging from the large loss incurred, it would seem much the better economy to provide suitable receptacles for the fuel, the saving in the latter being sufficient to compensate for the extra expense.

POLLUTION OF THE CLYDE.—The *London Gazette* of the 22nd inst. contained an announcement that the Queen had been pleased to appoint Sir John Hawkshaw, Knt., one of the honorary councillors of the Institution of Civil Engineers, to be Her Majesty's commissioner for the purpose of inquiring as to what towns and places contribute to the pollution of the river Clyde and its tributaries; and how and by what means the sewage of such towns and places, and the refuse arising from industrial processes and manufactures carried on within the same, can be utilized or got rid of without risk to the public health, or serious injury to such processes and manufactures otherwise than by discharge into the river Clyde and its tributaries, or be rendered harmless before reaching them; and also for the purpose of inquiring into the best means of otherwise securing the purification of the said river and its tributaries, and of remedying any evils or inconveniences arising from its present polluted state.

POLLUTED WELLS AT BIRMINGHAM.—At the meeting of the Birmingham Town Council on the 22nd inst., Mr. Kneebone—who had a notice on the *agenda* to ask the chairman of the Sanitary Committee whether any action was proposed to be taken with reference to those wells so strongly condemned by Dr. Hill, the medical officer of health, in his last report—remarked that the resolution of the Council to seek parliamentary powers for the acquisition of the water-works to a great degree removed the necessity for his question. He did, however, consider that some action should at once be taken with reference to those unwholesome wells to which Dr. Hill referred. Mr. Cook said he was much obliged to Mr. Kneebone for having brought this matter forward, as it afforded him an opportunity of informing the council what the Sanitary Committee were doing. At the present time the committee were collecting a sanitary census of the borough, having especial reference to the well and pump water supply. They had also requested the medical officer of health to report generally as to the state of the wells. These matters were being pushed to a conclusion as fast as possible, and when completed the committee would no doubt bring their recommendations before the council.

GOOLE WATER SUPPLY.—Mr. W. H. Bartholomew, C.E., of Leeds, has made a preliminary report on the above subject, in which he says that the chief supply was now obtained from comparatively shallow wells, sunk down to a thin gravel bed, which is generally found at a depth of from 25 to 40 feet from the surface. It would be readily conceived that water derived from such a source, percolating as it does through the peat and alluvial soil, could not, under the most favourable conditions, be expected to yield water of a satisfactory quality. This observation was corroborated by experience at Goole, and the quantity obtained from this stratum was also very insufficient. The district undoubtedly required a more abundant and purer water supply than it at present enjoyed. Such sources as the surrounding tidal rivers, together with the docks and canal, might be at once disregarded, as being totally unsuited for domestic purposes. The only remaining available source was the red sandstone, which fortunately laid beneath the whole of the district, and which was computed to extend continuously over an area of about 760 square miles, thus affording an almost inexhaustible resource. The upper red sandstone rock, which at Selby was found at a depth of 132 feet, was reached near Reedness at 342 feet; it consequently may be expected to be found at a depth of 275 to 300 feet at Goole. The Reedness borings proved this rock to be 170 feet in thickness, whilst at Selby it was proved to be practically the same. At the latter place, however, it was necessary, in order to obtain a sufficient supply, to pierce through this upper rock, and to continue the borings to a limited extent into the lower stratum of red sandstone. The Reedness borings indicated the thickness of this last-mentioned rock to be 233 feet. Mr. Bartholomew recommends that preliminary borings be made at Goole, and also at selected intervals of a mile, for at least three miles westward of Goole, in order to prove the upper measures—say, for 100 feet in depth. The information thus obtained would afford the means of determining the most favourable position for a well. Till this has been done it is impossible to consider the question of cost.

DESTRUCTIVE FIRE AT THE ACCRINGTON GAS-WORKS.—Early in the morning of Christmas-day, a fire broke out at these works, doing damage to the amount of about £800. Recently handsome new offices were erected by the company, and in the stone block that was built were comprised the secretary's office, the clerks department, store-room, weighing-place, and an apartment where the regulating governor was located. The structure was two storeys, and had been decorated and furnished in the most complete manner. The frontage was in Hyndburn Road, and a few yards from the building is a block known as the manager's department, which is entirely detached from the secretary's offices. Stretching at the rear of these two buildings are the works proper, two large gasholders and other necessary erections for supplying gas. It was in the room in which the governor was placed that the fire originated. About a quarter to six the man who manages the governor entered the room as usual with the light, to regulate the pressure. As soon as he entered, a loud explosion of gas occurred, and he was burnt very severely about the face and body. Flames arose from a leakage of gas in the governor, the alarm of fire was immediately given, and the fire-bell was rung by the police. A strong *posse* of police were the first at the scene of the fire. The fire brigade and engine were also promptly on the spot, and they soon got the hose to work and the water to play, being assisted in their efforts by the workmen on the premises. Mr. Key, manager, and Mr. Duxbury, secretary of the company, were also soon on the spot, and Mr. Key was unremitting in giving the necessary directions. It was evident from the commencement that the only issue of fire was from the ignited gas leaking out of the regulating governor, and the great object was to exhaust all the gas in the governor. Under ordinary circumstances, this could have been done in a few minutes, and the result would have been the salvation of the building. But it happened, unfortunately, that the valves through which the gas passes from the large gasholder near the building were unworkable, owing to the severe frost. Consequently, the gas could not be shut off, and it continued circulating through the main from the large gasholder into the governor, thereby keeping up a continual supply of gas, and causing the flames to mount higher and higher. There was plenty of water at hand, but, in face of the fact that fuel was continually being added to the fire, the water had little effect. The flames, catching at the dry timber, spread very rapidly from the room where the fire originated and the conflagration swept upwards and onwards until it got to the roof and reached every corner of the building. The large gasholder stands nearly touching the building that was on fire, and the firemen now made it their sole object to beat back the flames from the gasholder, and in this they succeeded. But before the flames had made much headway Mr. Key, after all attempts to loosen the valves at the gasholder had failed, hit upon a plan of staying the circulation of gas into the governors. Opening the drip-boxes in connexion with the gasholders, water was poured down, and by this means the gas supplying the governor was shut off and the cause of the fire stopped. When this was done the firemen put forth every effort to subdue the flames and keep them from the large gasholder. They fortunately succeeded in the latter object, but the flames had got such firm hold that the building was a complete wreck before the conflagration was over. The fire was got under shortly after seven o'clock. Everything in the building, except the contents of the safe and some business books, was destroyed. Some valuable papers, books, and documents fell a prey to the fire. The premises were not insured, and, as we said before, the damage will be about £800. It appears that the governor was made of block tin, with soldered seams, instead of rivets, and the solder from one of these seams had given way and caused the leakage, and as the fire continued it loosened more seams, and hence the increasing flames. It was an old governor, and was about to be replaced by a new wrought-iron one. When the fire commenced all the lights in the town were extinguished, and the gas could not be lighted. Arrangements have since been made to keep up a full supply.

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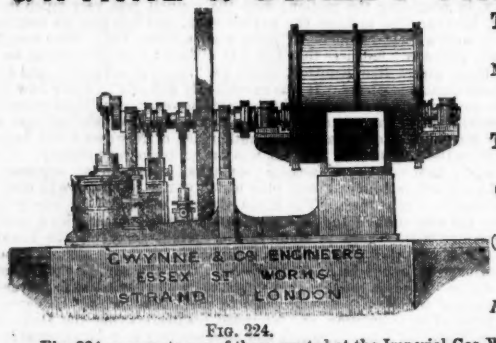

FIG. 224.

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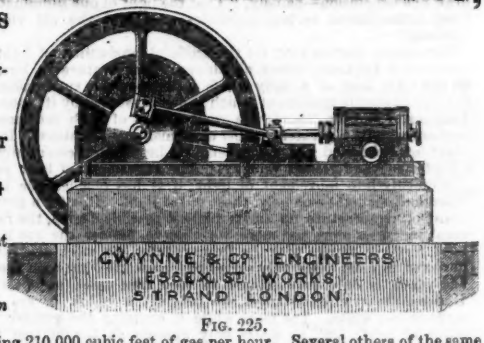

FIG. 225.

Fig. 224 represents one of those erected at the Imperial Gas-Works, Bromley, capable of passing 210,000 cubic feet of gas per hour. Several others of the same size are now on order for the same Company. These Patent Machines combine the highest quality of workmanship and materials, the largest bearings and wearing surfaces, with the **most perfect system of action yet discovered.** Fig. 225 represents one of a series of four at the Nottingham Gas-Works, each passing 52,500 cubic feet per hour. GWYNNE AND CO. *do not pretend to enter into a struggle with other makers in respect to cheapness. They have never sought to make price the chief consideration, but to produce Machinery of the very highest quality, and the most approved design and arrangement.* Their prices have been estimated with a due regard to the **excellence of the article produced,** and when this is taken into consideration, they have no fear for the result. The orders executed this season for Exhausters and alterations to their patented system amount to over 4,000,000 cubic feet of gas passed per hour, and to over 800 horse power for Engines to drive them. In every instance their work is giving the greatest satisfaction. Numerous testimonials and references can be given.

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Chief Office, Horseferry, Road, Westminster, S.W., Dec. 24, 1874.

TO PIPE-LAYERS AND OTHERS.

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Forms of specification and tender may be obtained on application to the undersigned, at the office of the Local Board, Town-Hall, Aberdare, South Wales; or to the Engineer, J. R. Bateman, Esq., C.E., 16, Great George Street, Westminster.

Tenders to be sent to me on or before the 13th of January, 1875, endorsed "Tender for Pipe-Laying."

The Board do not bind themselves to accept the lowest or any tender.

By order,

R. ORTON GERY, Clerk to the Local Board.

Dec. 10, 1874.

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The Tenders to be sent in addressed to the Secretary of the Locomotive Committee, Midland Railway, Derby, and to be received not later than 9 a.m. on Tuesday, Jan. 5, 1875.

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JAMES WILLIAMS, Secretary.

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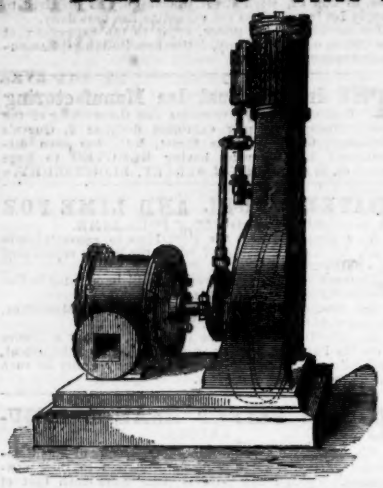

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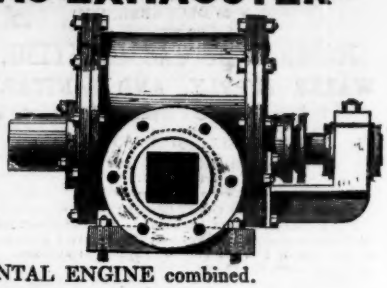

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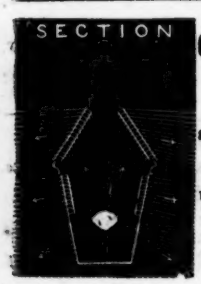

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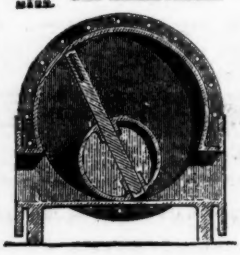

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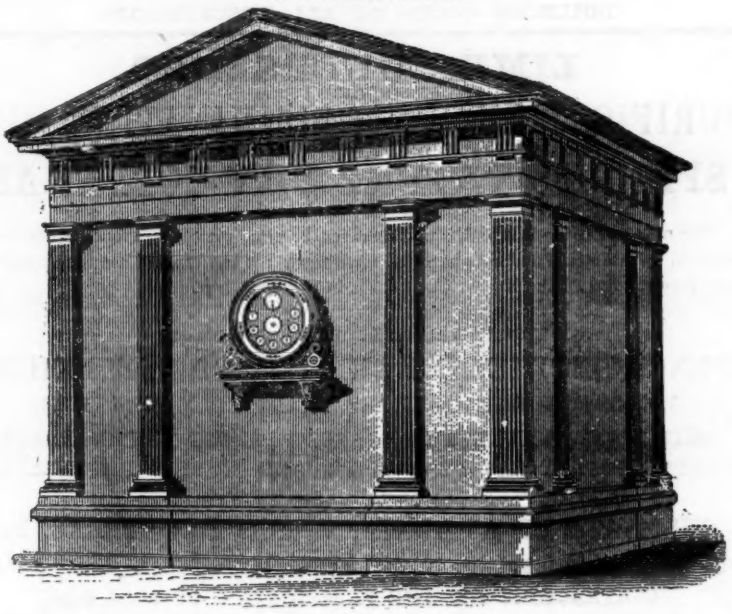

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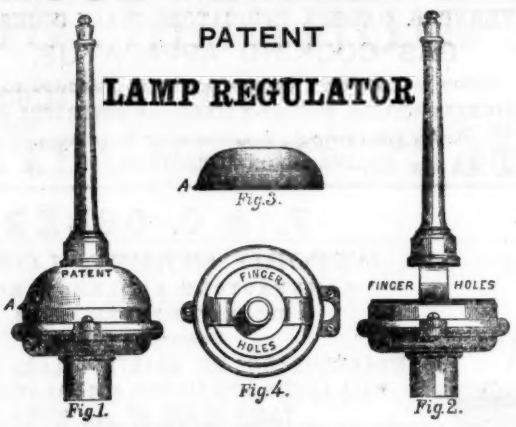

Fig.1. Fig.3. Fig.4. Fig.2.

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"A few years ago, a simple form of Gas Regulator for Street Lamps was introduced, I do not know by whom, and various forms of it, and improvements on it, have been made by many practical gas engineers. Of all the modifications of the instrument, the best in my opinion is that of Mr. D. Bruce Peebles, of Edinburgh; in fact, his Lamp Regulators are so superior that they are likely to supplant all others. Already about 9000 of these have been applied to the street-lamps in Glasgow, and I understand it is the intention of the authorities to introduce them all over the town. The saving thereby effected I calculate to be about £6000 per annum, without any diminution of light. One of the great advantages of Mr. Peebles's apparatus over all others is that it can be regulated while the gas is burning."

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NOTE.—The illuminating power of the gas was tested by the standard burner now used in London by the Gas Referees, under the City of London Gas Act, 1868.

Horseferry Road, Westminster, March, 1870. (Signed) F. J. EVANS.

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